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The Bristol Medico-Chirurgical Journal.

"Scire est nescire, nisi id me
Scire alius sciret."

JULY, 1917.

FATIGUE INDUCED BY LABOUR.[1]

BY

A. F. STANLEY KENT, M.A., D.Sc., Oxon.,

Professor of Physiology, University of Bristol.

The address included an account and demonstration of the methods and apparatus employed in recent researches on industrial fatigue amongst munition and other classes of industrial workers.

THE subject of industrial fatigue has long interested me, and experiments had already been undertaken in my laboratory some years before the war began. When that happened the work gained additional interest, in consequence of the bearing which it had on the production of munitions of war. Since then nearly the whole of the energies of three workers have been devoted to the inquiry.

The simplest form of fatigue may be illustrated by taking as an example a physical system which possesses a certain

[1] An address given at the meeting of the Bristol Medico-Chirurgical Society on February 14th, 1917.

amount of energy, and from which energy is lost at a definite rate. Many of us on these dark nights have endeavoured to avoid fellow-passengers in the streets by the aid of pocket flash-lamps, and many have been disappointed to find how short a time they lasted. Such a lamp may be taken as an example. The chemical energy of the cell is gradually dissipated, and the apparatus becomes "fatigued," the fatigue being represented by a simple loss of energy.

In the same way it is possible to demonstrate the dissipation of energy in a muscle. If a muscle be cut from the body and placed in suitable surroundings, it will be found to possess energy, but the amount of energy it can transform is limited. This is illustrated in the experiments upon the table. When fatigued these muscles have lost energy, and in that way resemble the exhausted flash-lamp. But other changes also have taken place, and in addition to being poor in energy, the muscle has become clogged with the chemical products of its own activity—"waste products," as they are called. That these waste products are important in the production of fatigue is shown by an old experiment, where a weak solution of common salt is passed through the blood-vessels of an exhausted muscle, with the result that a remarkable recovery takes place, though from its nature the salt solution is evidently incapable of replenishing the store of energy. The recovery in this case may not unreasonably be attributed to the removal of waste products.

Things are somewhat different when a muscle in the body is considered. Here the circulating blood continually brings new stores of energy, whilst the waste is as continually removed. It might be supposed that fatigue would be postponed indefinitely, and indeed fatigue in its extremest grades is so postponed for the life of the animal, provided that certain necessary conditions be fulfilled. For instance, food must be taken, digested and absorbed, or the blood itself

will become starved and no longer capable of nourishing the muscles, and periods of rest must be afforded for the repair of the tissues.

It is evident then that one of the causes of fatigue is the using up of energy, and another, and a very important one, is the accumulation of waste products.

So much for muscle. But the nerve, which is attached to the muscle, has to be considered also. The actual nerve fibre is very resistant to fatigue. It may be stimulated artificially for a long time, and will show but slight signs of change. It is otherwise with the special connecting-link between muscle and nerve, for here there seems to be a mechanism which may be tired easily. But even this is not the weakest link. In a workman turning out munitions of war or other product, we have neither a set of simple muscles, nor of muscles attached to simple nerve fibres carrying on the work. The whole apparatus is under the control of the central nervous system, and as the central nervous system is the most highly organised portion of the mechanism, so it is the most delicate, and the most easily fatigued. It follows that the condition known as industrial fatigue concerns the central nervous system far more closely than it does the nerve fibres or muscles. And since a delicate and highly-organised mechanism is concerned, it is not surprising to find that it is susceptible not only to the influences of activity —the normal producer of fatigue—but also to the influence of a great variety of other agents. Chief amongst these is the poison sometimes produced in the alimentary canal as a result of disturbances of digestion. Persons who suffer from dyspepsia not infrequently show signs of fatigue also. They are tired when they get up in the morning, tired when they go to bed at night, and yet they often lead by no means active lives. It is probably a case of poisoning by toxins absorbed from the intestine, and it is interesting to note that poisons

of a somewhat similar nature may be isolated from the blood of a fatigued animal, and when injected into the blood will cause signs of fatigue in an animal which has not been active. Some persons have even gone so far as to assert that not only toxins of fatigue, but antitoxins also may be produced, and that these last, when passed into the blood of a tired animal, are able to abolish the signs of fatigue.

The Italian physiologist Mosso has described an experience which shows how greatly the effects of fatigue may be accentuated when the blood supply is even partially cut off from the central nervous system. He describes the flight of quails, which at certain seasons of the year cross over to Sicily from the opposite coast of Africa, about one hundred and fifty miles distant. On their arrival the brains of these birds had become very anæmic, and as a result of this and their long flight they were quite unable to see. Indeed, on landing they often dashed themselves against trees and other objects in their path, and Mosso asserts that the natives, knowing this, were accustomed to resort to the sea-coast and collect the birds for food.

To come nearer home. The late Sir Lauder Brunton describes an experience of his own whilst he was working in London. After a long day at the hospital he arrived home one night to find a letter awaiting him from the editor of a journal to which he was accustomed to contribute. The editor required an article on a certain subject that night. We all know what it means to do extra work of this kind after a hard day's work, and can sympathise with the author. However, he determined to write the article, and sat down to do so. But he found to his exasperation that no ideas would come. He then began to wonder what the reason could be. Yesterday he could have written the article easily ; his brain to-day was the same as yesterday, only that yesterday he was not tired. And then he thought that perhaps it was

because to-day he was tired, and the blood was not circulating through the brain in sufficient volume to refresh the centres, that his ideas refused to flow. Therefore, as the blood could not reach the brain, he determined to bring the brain down to the level of the blood, and this he did by laying his head upon the table. At once he began to write easily, though as soon as he raised his head all ideas left him. The article was accordingly finished with his head resting on the table.

Mr. W. G. Lecky, the historian, was described as having a large, magnificent head on a long and willowy neck. In his case also it is asserted that the circulation was not sufficiently vigorous to carry enough blood to the brain whilst he was in the erect position, and that therefore his famous works were written whilst he lay upon a sofa. The fact apparently is that he did not actually lie upon the sofa, but knelt upon it, and used its broad flat end as a desk.

Probably the popular idea of an American business man sitting in a chair with his feet on the chimney-piece has a similar origin.

Industrial fatigue is more complicated than any of the forms so far mentioned. It depends on muscular and mental fatigue, on worry, bad atmosphere, ill-health and starvation. It varies in amount in different factories, and in the same factory it varies with the type of worker, and with the particular conditions present. But it is a mistake to suppose that it is determined entirely, or even principally, by the conditions inside the mill. The home conditions of the worker, the distance he lives from his work, the nature of his leisure occupations—if any—and, above all, the nature and the adequacy of his food—these things exercise a most important influence upon the character and the grade of fatigue. Factory conditions are important also, but the authorities take care that these shall be at any rate tolerable. They cannot secure fresh air, however, since the workers are

often stubbornly set against it, and even where new ventilating apparatus has been installed will see that it is not used. This avoidance of fresh air by the worker is probably due to two causes. Many of them have been brought up to regard open windows with horror, and they are often so insufficiently clothed that free ventilation means discomfort from cold. The result is that a close atmosphere is preferred, and they will often stay in the corner of a stuffy workroom rather than go into a properly-ventilated mess-room for a meal.

In addition to such general causes of a lowered vitality, in many factories there are special conditions connected with the work which are detrimental to health. In a room where cyanide gauze was drying the whole of our party were convinced that they had caught severe colds, and one of them even sought a chemist in order to purchase a remedy. But on the following day all the "colds" had disappeared. Nevertheless, constant exposure to dust capable of producing such effects must have an influence upon the general health, more especially as one of the constituents of the dust is a salt of mercury. Indeed, an examination of the teeth of operatives in the room showed that this was the case.

The manufacture of surgical dressings will be of interest to a medical audience. A good deal of time was spent in investigating conditions in a factory devoted to such work. It may be supposed that the processes were simple, but it must be explained that all the processes from raw cotton to finished dressings of various kinds were carried out in one mill. Some of these processes are as follows: opening, cleaning, carding, spinning, winding, warping, setting-in, slashing or taping, weaving, bleaching, washing, drying, lint making, dyeing, impregnating with antiseptic, compressing, packing. Other works visited were engaged in coal mining, chemical making, engineering, printing, the manufacture of

explosives and army stores. Every one of these industries is divided into numerous separate processes, so it is not surprising that the number of individual tests carried out already exceeds forty thousand.

Some of the tasks performed entail heavy labour for girls, and even for men. Other processes involve but little actual labour, but constant watchfulness. Views illustrating the character of the work, and the type of operative employed, are thrown upon the screen.

The actual tests used were for a time a matter of anxiety. Even muscular fatigue requires care for its proper registration ; industrial fatigue, depending upon the diverse causes described, is elusive and difficult to detect with certainty. It is still more difficult to estimate and to measure. Moreover, of the tests available for the measurement of fatigue, very few can be used in a factory, where leisure is scanty, habits rough, and workers altogether unaccustomed to scientific methods. The tests selected must be quick, easily carried out, and, in order that wilful interference with results may be avoided, beyond the control of the examinee.

The tests which have been adopted are four in number, viz. measurement of the reaction time, of the acuity of sight, of the acuity of hearing, and of blood pressure. A complicated reaction was selected so that the time measured might be as long as possible ; in this way the relative magnitude of the experimental error was diminished. Blood pressure is affected by a great variety of conditions, but when properly safeguarded its measurement gives valuable results.

The factory day is divided up in a different manner in different parts of the country and in different industries. One method is to divide it into four periods, which for description I have called early morning period, morning period, afternoon period, and overtime period. The early

morning period begins at 6 a.m. and ends at 8 a.m., there is then half an hour's interval for breakfast. The morning period begins at 8.30 a.m. and ends at 12.30 p.m., there is then an hour's break for dinner. The afternoon period begins at 1.30 p.m. and ends at 5.50 p.m., when there is half an hour's interval for tea. The overtime period in this particular mill begins at 6 p.m. and ends at 8 p.m.

The two slides now shown have been drawn from curves obtained from two different individuals of a group tested by different methods. As will be observed, the form of the two curves is similar, an indication that similar conditions of labour produce in similar individuals similar amounts of fatigue, and that different tests record these in a similar manner. The broad outlines of the fatigue curve are shown also—the fall during the day, indicating development of fatigue, the rise at night, indicating recovery; the gradual decline during the week, indicating the accumulation of fatigue through the carrying over of balances from day to day, the greater effect of an overtime day in producing fatigue, and the lessened resistance towards the end of the week.

The tests made were not confined altogether to the operatives of the factories. Members of the office staff have been tested over a considerable period, and the fact established that here also a large amount of fatigue may exist.

Amongst the workers it was found that the amount of fatigue varied considerably in different periods of the day, and an examination of the curves of output led to the same conclusion. Contrary perhaps to expectation, it is found that the early morning is not the time of greatest activity. The output in this period may be conspicuously bad. In the two middle periods of the day output is good. The reason is not far to seek. In regarding the early morning as a time of great activity, food, warmth, and comfort are

pre-supposed. In a factory where work begins at 6 a.m. many workers arrive either unfed, or having taken merely a cup of tea. It is not until the eight o'clock breakfast interval that they take a satisfactory meal. With regard to warmth, the mill is often chilly in the early morning, and does not become comfortably warm until an hour or so later. And it must not be forgotten that many of the hands are badly clothed. The result is the unsatisfactory output mentioned.

In the middle-day periods the conditions are better, and output is correspondingly higher. In the period which is described as overtime, and which is only worked in times of stress, the condition of the worker with regard to fatigue, and the output, are alike bad. A fair day's work has already been done, fatigue has accumulated, rest is due, and powers low. In this period it is significant that a given task will produce greater fatigue than in the earlier periods of the day.

As might be expected, some difference is found between the effects of work performed at night and the ordinary daily task. Night work is more tiring than day work as a rule, but the statement requires to be explained. It is well known that the physiological processes are at their lowest ebb in the early morning, and it is reasonable to expect that a given amount of work performed at that time would result in a maximum amount of fatigue. Where experiments have been made the expectation has been realised, but only at the commencement of a spell of night work. The human organism is extraordinary in its power of adaptation to new conditions, and no sooner are such conditions as those attending night work imposed than adaptation commences. The result is that in a short time the period of minimal physiological activity becomes shifted from the early morning to the early afternoon, and the time at which work is now performed is made to correspond with the time of physiological activity. The body is tuned to a new rhythm, and

its performance becomes as efficient as ever. So long as the labour by night and rest by day go on, the physiological reversal will persist, but should the old arrangement be reverted to a new adaptation will be required, and as this will take some days to become complete, a period of inefficiency will appear. It is an example of how ignorance of physiological fact may interfere with efficient organisation, that in many mills efficiency is constantly prejudiced by a weekly change of individuals from night work to day work, and *vice versa*, for it is evident that such frequent change involves constant new adaptations, and as these take some days for their completion, the proportion of days on which efficiency is high is greatly reduced. It is hoped that this cause of inefficiency may be dealt with in the future.

Another factor which tends to upset the regular accumulation of fatigue throughout the week, and which will have to be considered in the future, is that which I have referred to as the "Monday effect." Lassitude and disinclination to work are often present on Monday morning, and diminished efficiency is observed when work is attempted. This condition is found not only in industrial occupations, but also in such as typewriting, knitting, shorthand writing, etc. My experience is that it is marked especially in occupations which involve the learning of complicated processes. It results generally in a poor condition of the worker on Monday morning, improvement towards evening, although work has been performed. Indeed, if no work be performed on Monday the condition of lessened efficiency is transferred to Tuesday, and work attempted on that day shows characters similar to those usually found on Monday. Under ordinary conditions, however, when work has been performed on Monday, and the evening improvement has occurred, the following night's rest, instead of increasing that improvement, will actually be followed by a deterioration, so that the condition is worse on

Tuesday morning than on the previous evening. Afterwards, the ordinary rhythm is observed, each evening showing a worse condition, each morning a condition of improvement.

The occurrence of such inefficiency at the beginning of the week is difficult to explain. It has been attributed to an unwise use of the week-end rest and of the week's wages. But alcohol apparently has nothing to do with it, whilst it occurs equally amongst those of regular and of irregular life. Moreover, something similar is to be seen in the daily variations of efficiency which have already been mentioned. It has been shown that the early morning period is generally a time of low efficiency, and that an improvement occurs as the day wears on. And—a very important point—so far as the Monday effect itself is concerned, it is not well marked in the case of unskilled workers. Thus the evidence points to the real cause of inefficient work on Monday, and in the first working period of any particular day, being traceable, not to any injurious influence acting on the worker, but rather to an abstention from work, resulting in operations which, as a result of practice, are ordinarily performed quickly and well, being to some extent forgotten, and to that extent requiring to be re-learnt before the old efficiency can be regained. It is, in fact, a case of a loss of co-ordination rather than of actual fatigue. The inefficiency often fails to show itself in operatives who are commencing new work, and in untrained workers imported from outside. These individuals, not having learnt the work thoroughly, show little deterioration as a result of the week-end rest. They have less to forget than veteran workers.

If now we consider the changes which occur during the course of a typical week, it will be found that two distinct processes are at work. It is the resultant of these processes that we measure. There is in the first place a gradual increase in the amount of fatigue produced by a given task.

A day's work on Tuesday is less exhausting than on Thursday or Friday. Moreover, the night's rest in very many cases is not sufficient to sweep away the fatigue of the day which it follows. For this reason a small balance of fatigue is carried over from each day to the next, and often amounts to something considerable by the end of the week. In addition, there is also a gradual diminution in the power of recovery, so that the night's rest is actually less effective at the end of a week than at its beginning. These two factors, working together, are responsible for the deterioration already described.

When Saturday arrives, the worker is as a rule quite ready for a holiday, and the week-end rest sweeps away the whole of the accumulated fatigue of the week. On Monday work is commenced with a new stock of energy. But if for any reason the week-end rest is abolished, and the worker is compelled to continue his labour without intermission, a new set of conditions is introduced. The weekly accumulations no longer being got rid of at the week's end are added together. The condition of fatigue persists, and tends to become exaggerated. From week to week and from month to month this goes on, and evidently breakdown must follow unless the process be stayed. For convenience, the process which appears to limit accumulation and prevent breakdown is called balancing. It is brought about partly by the adoption by the worker of a less strenuous attitude towards his work, and partly by an actual shortening of hours by late beginnings, early endings, and short breaks and intervals throughout the day. In this way we may explain the fact generally acknowledged in America, and gradually winning a way to acceptance here, that a too long day is extravagant, and that "shortening the hours increases the profits." This is probably true in many industries, since a long day means a slack day, with unsatisfactory output, whilst

running expenses continue for a greater number of hours than when the day is short.

It has been said by some that the estimation of fatigue by physiological methods is unnecessary, since an excellent index is afforded by the output. Up to a point this is true, but it must be recognised that output is governed by other conditions besides fatigue, and it is evidently impossible to gain any knowledge of the state of the worker during rest periods and holidays through an examination of output, since at these times it does not exist. Nevertheless, the estimation of output is of value in a study of industrial conditions, and cannot profitably be neglected. Sometimes it involves only the taking of periodic readings from dials attached to machines, and under such circumstances it is easy. But it may necessitate wearisome countings of units, when it is difficult, and it becomes impossible and the method fails when several individuals work in a group, and the constitution of the group is changed at irregular intervals.

These are some of the results of our inquiry. What of their value? Their immediate value lies in the light they shed on conditions of maximum output. Maximum output of certain kinds of military supplies has been, and now is, of vital importance to this country, and contributions to that end are of value. But when the war is over, we shall be faced by a problem of equal gravity. We shall have to settle the relations that are to exist in future between capital and labour.

Our endeavour to establish a proper understanding between master and man will be easier if it can be shown that by a shortening of hours wages may be increased, output may be augmented, and vast numbers of workers may be given time and opportunity for leisure and relaxation, and the living of their lives as reasonable beings instead of as mere machines. The old order has changed. Wages have altered. Cherished

ideals of the Trade Unions have been put on one side for the sake of the country. When peace comes any attempt to go back to the old regime must lead to industrial strife. And yet industrial peace is essential in order that we may be able to deal with attempts—organised on perfect lines and lavishly financed—that will be made to steal our trade. Help given at such a time will be worth much. And it is not impossible that help may be derived from the information which has been gained. It has been shown that in certain industries maximum output—sought by capital but regarded by labour with indifference—is not necessarily bound up with long hours. It has been shown that high wages—sought by labour but not always welcomed by capital—go naturally with short hours and augmented output. It has been shown that ideal conditions for labour—short hours and high wages—go with conditions most favourable for capital—high output and low establishment charges. It has been shown that the true interests of capital and labour may be identical, and that they should work in harmony to the confusion of their foreign competitors.

The war after the war will be at least as fierce as the present struggle; it is likely to be carried on with similar unscrupulousness. Upon its results will depend the position of this country amongst the nations of the world.

At present the inquiry has been applied to comparatively few industries. Conditions differ, and what is true of one may not hold for another. We should be in a stronger position if we had accurate information with regard to the relations of fatigue, output, and wages in representative industries throughout the Empire.

GUNSHOT WOUNDS OF PERIPHERAL NERVES.

BY

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INJURIES of peripheral nerves occur in wounds due to projectiles of high velocity with great frequency, and their successful treatment is of the highest importance in the prevention of permanent disabilities of the most serious kind. It may be said at once that we are not yet in a position to make positive statements as to what the ultimate results of nerve injuries and the operations undertaken for their relief will be.

The nerves most frequently affected are the musculo-spiral, median and ulnar in the arm, the sciatic, and especially its external popliteal branch, in the leg.

Injuries to the brachial plexus are also common.

A nerve may be (1) completely divided—when this is so there is rarely a clean cut through it, but more often destruction or obliteration of it for a considerable distance, from one to several inches; or (2) partially divided, or (3) injured by compression in scar-tissue, by callus, by fragments of bone, by a lodged bullet, or portions of clothing, or by a traumatic aneurysm, by bruising or concussion.

It is important to remember that perineural scars and adhesions, though conspicuous at operation, may not be responsible for blocking the passage of impulses, but that this may be due to concomitant intra-neural hemorrhage, fibrosis (neuroma), or molecular changes of concussion. Trotter and Davis have shown the intolerance of the ordinarily isolated

nerve-tissue to the contact of connective tissue, and that the active out-growth of nerve fibrils of a divided nerve is a response to the contact of non-nervous tissue, which on its part forms a tough, fibrous capsule around them, and prevents their further extension ; this may lead to irritation of the nerve and hyper-sensitiveness.

The extensive experiences of the war should give more exact knowledge as to the course in the nerves of the individual nerve bundles to different muscles, information which is much needed for more exact plastic surgery.

The location of the injury to a nerve rests on anatomical data, and on the course of the projectile, aided by X-rays as to the presence of foreign bodies. In multiple wounds the diagnosis of the one causing the lesion is made from anatomical considerations. The extent of damage to the nerve is estimated by investigation of motor and sensory paralysis, muscular wasting, pains and hyperæsthesia, trophic lesions, and electrical reactions, and all of these symptoms which are present should be compared, and the diagnosis based upon the full results. There is no short cut to diagnosis. Many consider that sensory changes give more important information both as to extent and progress of the lesion than motor paralysis or electrical reactions.

It has been claimed that in incomplete division of a nerve the area of loss to protopathic is greater than to epicritic sensation, and that the borders of the respective areas approach and recede from or cross each other ; but this is not yet established.

It is certain that the distinction between complete anatomical division of a nerve and physiological blocking of it by involvement in scar tissue cannot always be made, for full sensory and motor loss with R.D. may be present in the latter.

Pains and hyperæsthesia mean partial injury of a nerve ;

when these gradually disappear and give place to analgesia and tactile anæsthesia compression of the nerve by scar tissue, callus, etc., is probably taking place.

Hysterical anæsthesia of the sleeve, glove or stocking type may be present as a complication of peripheral nerve-injuries, generally in partial ones. In gunshot wounds, however, especially of plexuses, the symptoms are often very complicated, and the sensory loss may not at first correspond with the known anatomical distribution of the nerves, and may resemble hysterical anæsthesia, but after a few weeks partially clears up leaving a residual loss in recognised areas of nerve-supply.

The severe forms of trophic disturbance, such as deep and intractable ulcers, usually occur in complete division of a nerve, the milder forms in partial lesions.

A lesion partial for a whole nerve may, however, be complete for one of its bundles of fibres ; this is not infrequent in the sciatic, where a wound of the nerve as high as the gluteal region may completely divide the external or internal popliteal fibres, most often the former, and leave the other little or not at all affected.

Much discussion has taken place on electrical reactions of damaged nerves. Electrical reactions give no information as to what is going on in the nerve at the seat of injury. Their most important function is to decide whether there are any excitable fibres peripheral to the injury. When all have been lost, voluntary power usually returns before the muscles respond to Faradism or the condenser. This fact, that electrical response does not go *pari passu* with voluntary power, is the chief reason why electrical reactions give such limited information as to extent of injury to nerve.

The Lewis Jones Condenser is now largely used for taking electrical reactions. Its great advantages are that it is reliable, gives sufficient information, is painless, and saves

time. On the other hand, it has been shown that the condenser discharges vary with the resistance and other factors, and that the patient's resistance is not constant, as for practical purposes it was at first assumed that it would be, and therefore caution is necessary in estimating the progress of a lesion by condenser reactions, for which it has been especially advocated. Further, the ready diffusion of the current renders its use difficult for small muscles. The advantages of the condenser, however, greatly outweigh its defects, and although some think that more information is to be gained from the older methods, it seems likely to come into general use.

As to treatment. Operations on cases in this country will be for secondary suture. Before operation can be done, (1) the wound must be soundly healed; (2) there must be a sufficient interval after the injury before exact diagnosis is possible, partly because characteristic signs of division of a nerve take time to develope, and partly because in most cases of gunshot wounds of nerves the extent of paralysis is at first more extensive than remains permanently.

Especially in wounds of a plexus, the immediate loss of sensation and motion may affect the whole limb, and after a time partially clear up, leaving a residual paralysis.

Whilst waiting, preliminary treatment must be carried out. This consists in wrapping the limb up warmly to protect it from cold and injury; in placing it on a suitable splint to keep the paralysed muscles relaxed—a point of the greatest importance; daily gentle massage and movements, during which the paralysed muscles must be kept relaxed; and electrical treatment by the passage of a constant current, or condenser discharge, rhythmically interrupted by a metronome, and just strong enough to cause a contraction of the muscle.

It is desirable before operation to give a prophylactic

dose of tetanus antitoxin, as tetanus may develop after operation undertaken some months after the original injury.

Operation is advisable (and, *ceteris paribus*, the earlier performed the better the results) (1) in complete division of a nerve; (2) in incomplete lesions (*a*) where the condition is stationary with a definite residue of paralysis after three to four months, (*b*) where improvement has begun but stopped abruptly, with signs of compression of the nerve by scar-tissue, callus, etc., (*c*) where there is great pain, not relieved after some weeks' careful treatment, the nerve should always be explored (pieces of bone, foreign bodies, or shreds of clothing may be found in the nerve); and (3) in cases of old standing with intractable trophic lesions, for even if no good to the paralysis results, the trophic lesions quickly heal.

In the majority of cases there is little difficulty in deciding whether operation is necessary or not. Even slight return of voluntary power negatives operation. In doubtful cases nothing is lost and often much gained by an exploratory operation, though occasionally the nerve may be found to be apparently normal in cases where the paralysis was complete. This is especially true of the musculo-spiral nerve.

In plexus lesions where several trunks have been divided, often at different levels with much perineural scar-tissue, accurate identification of trunks and end to end suture is most difficult, and if found impossible, it is probably better to leave things alone than to do indiscriminate nerve crossing. Trotter advises early operation in cauda equina lesions in every case where there is the least suspicion of an element of pressure.

The post-operative treatment, and that of cases of partial division of nerves is the same as given above in preliminary treatment, and should be continued daily until there is a return of voluntary impulses, which may take weeks or years. In the lower extremity a walking instrument must also be

provided for dropped feet. After end to end suture of a nerve electrical treatment should not be begun for some little time, and then with great care.

In all cases, especially in the early stages, care must be taken to avoid fatigue of the muscles by electrical treatment; the balance of evidence is that contractions due to electrical stimulation are beneficial in the stage of regeneration, but have no effect on muscular wasting. In later stages there may be irreparable paralysis and joint or bone lesions so severe as to neutralise the effect of recovery of paralysed muscles; for such cases operations for tendon transplantation or arthrodesis may be advisable.

As to results. Cases of nerve concussion should recover within four to six weeks; partial division of a nerve should go to complete recovery in several months (? two to six).

As to cases of complete division with secondary suture, it is not yet time to speak as to the results. Meanwhile, some statements of recent experiences seem to show a much earlier return of sensation and motion than was before held possible. The greater the distance from the periphery the site of the lesion the longer is the period before recovery.

OPERATIVE PROCEDURES AND FINDINGS, BY CAPT. RENDLE SHORT, M.S., F.R.C.S.

1. The nerve may appear to be normal (*vide supra*).

2. Complete division of the nerve, with a bulbous swelling at the end of the upper segment, succeeded by a mass of scar-tissue of variable thickness, and adherent to the surrounding tissues. The treatment adopted is to free the two ends of the nerve, cut off the upper segment through the upper end of or above the bulbous swelling, so as to expose visible nerve-bundles with no excess of interstitial fibrous tissue, and suture with catgut. Many English surgeons wrap

the junction in Cargile membrane; others sometimes use a segment of saphena vein, but often nothing is used.

It frequently happens that the ends cannot be brought together because of a gap of one to two inches. This is bridged by two or three plies of internal cutaneous nerve from the upper arm, but some surgeons use catgut strands, and others employ nerve-anastomosis.

3. There may be a bulbous swelling on the nerve, adherent to the track of the bullet, and it may be doubtful whether the nerve-fibres pass through it or are interrupted. In such a case we stimulate the nerve electrically above and below the bulb. If, in the case of a small or medium-sized nerve (not the sciatic), any muscles supplied by it contract, the scar is freed and wrapped in a segment of saphena vein. If there is no response, we excise the scar and suture.

4. A large nerve, such as the sciatic, may show symptoms of a partial division, and at operation part of the nerve shows a scar. The best procedure is to take out a quadrilateral, including the scar, and, by splitting the nerve-trunk up and down, to bring the two ends together, leaving the intact portion of the nerve undisturbed.

5. The nerve may be intact, but pressed upon by a bullet or by shattered bone. The treatment is to remove the cause of pressure, but although this relieves pain at the time, it is apt to return during the process of healing, and prove very intractable.

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THE PREVENTION OF SEPSIS IN WAR WOUNDS, WITH SPECIAL REFERENCE TO THE CARREL-DAKIN METHOD.

BY

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DURING my visits to France I have seen many hospitals in the English and French lines and in Paris where the scientific methods with which war wounds are now treated, even within a few miles of the firing-line, are in noticeable contrast with the unsatisfactory procedures adopted at the beginning of the war.

The control of infection and suppuration in war wounds is now almost a matter of mathematical certainty. Microscopic tests as to the progress of the sterilisation of wounds are applied, and the rate of progress of the healing of aseptic wounds can be definitely calculated and represented by a geometrical curve.

At a time when the base hospitals in England were filled with a large proportion of suppurating cases (much of which was due to the re-infection of wounds during transport), it was strange to see printed in large type in M. Tuffier's wards at the Beaujeu Hospital a notice, in French, to the following effect: "Every patient whose wound suppurates has the right to ask the reason of his surgeon." The statement was amply justified, for in this hospital, and elsewhere, pus was practically non-existent, wounds were supple and free from inflammation and pain, compound fractures were healing like simple ones, and empyemata were converted into cases of sterile pneumothorax. Early treatment is highly desirable, and as this can be commenced in France soon after the infliction of the wound, most of the cases are rendered "sterile," and closed, with about 99 per cent. of successes, in the course of five to twenty-five days.

The hospitals to which these remarks refer have adopted the Carrel-Dakin method of treatment, and it is easy to see from what has been said how much suffering is prevented, and how many limbs and lives have been saved by this means of prevention of sepsis.

In order to be successfully applied, great attention to detail is necessary, and as there is considerable misunderstanding on some points, it is desirable to state some of the methods adopted by the staff at Carrel's Hospital at Compiègne, where I was sent by the War Office to study this form of treatment.

The fluid used to "sterilize" the wounds is Dr.

Daufresne's modification of Dakin's solution of hypochlorite of soda. It must be free from caustic soda, and should contain exactly between 0.45 and 0.50 per cent. of hypochlorite of soda—under 0.45 per cent. the solution is not active enough, and over 0.50 per cent. it is irritant.

The solution is made by mixing chlorinated lime (bleaching powder), dry carbonate of soda and bicarbonate of soda in water; but as the amount of active chlorine in bleaching powder varies within wide limits, it is necessary to titrate the bleaching powder before use.

The following instructions for titrating the chlorinated lime and preparing the solution are taken from a paper supplied from the laboratories of the Rockfeller Institute at Compiègne :—

Technique of the titration of chlorinated lime (bleaching powder).—Obtain an average sample of the bleaching powder by mixing small quantities obtained from different parts of the material. Weigh 20 grammes of this, mix it thoroughly in a litre of water, and allow it to stand for some hours. Filter.

Measure exactly 10 c.c. of the clear fluid with a graduated pipette, and add 20 c.c. of a 10 per cent. solution of iodide of potassium, and 2 c.c. of acetic acid or hydrochloric acid. To this mixture add, drop by drop, a decinormal solution of hyposulphite of soda until decoloration is complete. The number of cubic centimetres of the solution of hyposulphite of soda required for decoloration, multiplied by 1.775, will give the weight of active chlorine contained in 100 grammes of bleaching powder.

This figure being known, the following table can then be used to give the quantities of chlorinated lime (bleaching powder), carbonate of soda, and bicarbonate of soda, which should be used to prepare 10 litres of Daufresne's solution :—

Figure for Active Chlorine per cent.	Quantities to be used to Prepare 10 Litres of Daufresne's Solution at 0.475 per cent. of NaCl.O.		
	Bleaching Powder.	Dried Carbonate of Soda.	Bicarbonate of Soda.
	gr.	gr.	gr.
20	230	115	96
21	220	110	92
22	210	105	88
23	200	100	84
24	192	96	80
25	184	92	76
26	177	89	72
27	170	85	70
28	164	82	68
29	159	80	66
30	154	77	64
31	148	74	62
32	144	72	60
33	140	70	59
34	135	68	57
35	132	66	55
36	128	64	53
37	124	62	52

Thus, for example, assuming it was necessary to use 16.6 c.c. of the decinormal solution of hyposulphite of soda to obtain decoloration, the percentage of active chlorine in the bleaching powder is 16.6 by 1.775=29.7 per cent. The quantities of the various ingredients for the preparation of 10 litres of the solution, in this case, would be—

Bleaching powder .. .. 154 grammes.
Dry carbonate of soda .. .. 77 grammes.
Bicarbonate of soda .. .. 64 grammes.

And if one has only the carbonate of soda in crystal form, it would be necessary to replace the 77 grammes of dry carbonate by 220 grammes of the crystallised carbonate of soda.

Preparation of Daufresne's solution (10 litres).—Weigh exactly the quantities of the various ingredients determined

in the manner already described. Put into a 12-litre flask the bleaching powder and 5 litres of ordinary (not distilled) cold water, shake vigorously for a few minutes, and leave for six to twelve hours, one night for example. At the same time dissolve the carbonate and bicarbonate of soda in 5 litres of ordinary cold water. After the lapse of six to twelve hours, pour the salt solution into the flask containing the macerated bleaching powder, shake vigorously for a few seconds and wait to allow the calcium carbonate to be precipitated. After about half an hour siphon the liquid and filter with a double paper to obtain a good clear solution. The solution must be kept in a dark place, as light rapidly destroys the sodium hypochlorite. It is best kept in large, wicker-covered, dark green bottles, and if five milligrammes of potassium permanganate are added to each litre of the solution, the stability of the hypochlorite is greatly enhanced The solution should be neutral, and should give no coloration on being tested by the addition of a few centigrammes of phenolphthalein in powder to 20 cubic centimetres of the liquid.

Titration of the Daufresne's solution.—It is desirable to verify the percentage of the solution from time to time. This is done in the same manner as the titration of the bleaching powder: measure ten cubic centimetres of the solution, add twenty cubic centimetres of a 10 per cent. solution of iodide of potassium, and two cubic centimetres of acetic acid; then add, drop by drop, a decinormal solution of sodium hyposulphite until decoloration occurs. The number of cubic centimetres used, multiplied by 0.03725, gives the weight of hypochlorite of soda contained in 100 cubic centimetres of the solution. The Daufresne's solution is of proper strength when it is necessary to use for discoloration 12 to 13 cubic centimetres of the hyposulphite solution. $13 \times 0.03725 = 0.485$ per cent. NaCl.O.

Method of Application.—It is unnecessary to describe this in detail, but briefly it may be said that, if possible, within a few hours of being wounded the patient is anæsthetised, foreign bodies and portions of clothing are removed from the wound, which is excised, thoroughly cleansed, laid freely open, and dressed according to the Carrel technique. Tubes (in number according to the size of the wound, of 4 mm. inside diameter, closed at the end, but having numerous fine perforations just above for 5 to 20 centimetres) are placed in the wound, supported loosely by gauze wrung out of Daufresne's solution or fixed in place by strapping. The skin around the wound is protected by pieces of gauze measuring about 6×12 c.m., soaked in vaseline and sterilised, and the whole wound is covered by a sterilised dressing passing round the limb, and consisting of a layer of absorbent wool inside (*i.e.* next to the wound) and a layer of non-absorbent wool outside enclosed in gauze. This pad is fastened with safety pins in such a way that the proximal ends of the Carrel's tubes project through the place of meeting of the edges of the wool dressing. (Fig. 1.[1]) To

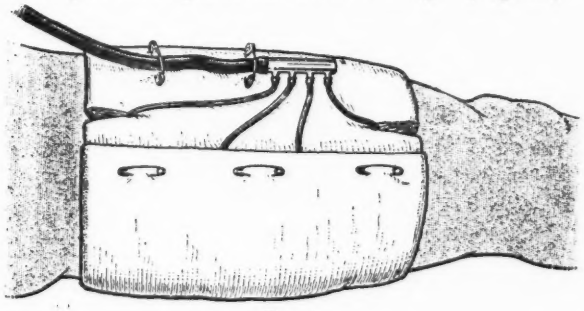

FIG. 1.

The disposition of a 4-way tube at the surface of a dressing (after Carrel).

[1] Figs. 1, 2 and 4 are taken from *Le traitement des plaies infectées*, par A. Carrel and G. Dehelly. Mazzon et cie, 1917. Fig. 3 is taken from *Pratique de l'irrigation des plaies dans la méthode du Docteur Carrel*, par J. Dumos et Ann Carrel. A. Maloine et Fils, 1917. Figs. 3 and 4 have been slightly altered.

the ends of the tubes glass connections of one to four openings (Fig. 2) according to necessity are fastened, and these glass connections are in turn connected by a rubber tubing, through which the Daufresne's solution runs from a reservoir of a litre in capacity, which is placed not more than three feet above the patient's bed. (Fig. 3.) On this main supply tube a clip is placed close to the reservoir, and the clip is released for about one to three seconds every two hours, so as to flood the wound

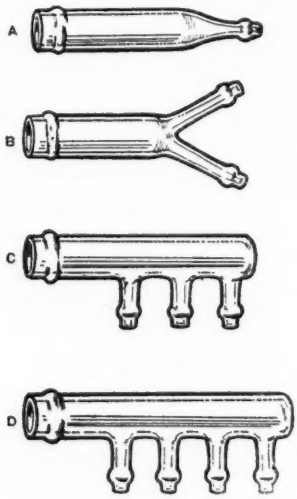

FIG. 2.
Different forms of glass distributing connexions (after Carrel).

according to its size with 20 to 100 cubic centimetres of the fluid. This flooding of the wound every two hours is sometimes arranged for by automatic mechanical or electrical devices. If the patient complains of pain, the reservoir should be lowered.

The wounds are dressed daily, but the tubes are generally changed on alternate days. When redressing takes place, the skin is cleansed with a solution of 20 per cent. oleate of

soda on small swabs of wool. The dressing of these wounds is carried out with the usual antiseptic precautions; the

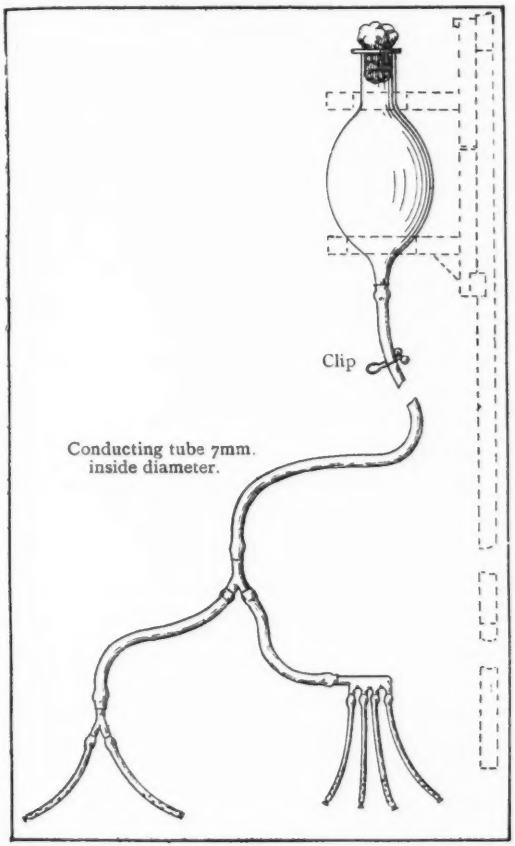

FIG. 3.
Scheme of general arrangement for the distribution of the fluid (after Carrel).

surgeon works in gloves, and all manipulations are carried out by means of two pairs of sterilised forceps, which are changed for each wound.

When the bacteriological examination (*vide infra*) of the wound shows it to be practically free from organisms, it is closed by suture or strapping without drainage, after excision of the skin edge.

With regard to the preliminary excision of the wound which has been referred to, it should be observed that if a wound can be thoroughly and completely excised within six or eight hours of the receipt of injury, it may be possible to close the wound at once, and get healing by first intention with or without antiseptics. When the wound cannot be thoroughly excised, or when more than eight hours have elapsed after the injury, the bruised or dirty tissues should be cut away as far as possible, the wound opened up, and Carrel treatment commenced at once. If the patient does not come for treatment until after twenty-four to forty-eight hours from the time of injury, Carrel thinks the wound should not be excised. In these last cases there should be as little surgical interference as possible, and foreign bodies are better left in until the Carrel technique has been carried out for some days. In short, surgical cleansing during the pre-inflammatory period should be complete, and is fairly free from danger ; but during the early days of the inflammatory period only such surgical intervention as may be absolutely necessary should be undertaken, as there is great danger of increasing the septic trouble. This risk is much less when suppuration is established.

Bacteriological Examination of the Wound.—It is quite impossible to tell the condition of a wound as regards infection from naked-eye appearances.

A microscopic examination of the secretions of a wound is necessary in order to ascertain the degree of infection at the beginning of treatment, to follow the progress of the effect of the antiseptic applied for the purpose of disinfection, and to determine the time at which closure

of the wound may be undertaken without danger to the patient.

The bacteriological examination now referred to is merely quantitative, and has nothing to do with the cultural methods employed to ascertain the nature of the infection. A smear is taken from the wound, fixed, stained with carbol-thionin, and examined under a $\frac{1}{2}$ in. immersion lens in the usual way. Carbol-thionin is preferred, but any other non-selective stain will do. Irrigation of the wound should be stopped at least two hours before the smear is taken. The number of organisms in the microscopic field is counted, irrespective of the variety of the organisms. By moving the slide, several fields can rapidly be observed, and the mean of the number of organisms seen is recorded on a chart. This process is repeated about every other day. At first the organisms may be very numerous; later, a diminishing number per field may be observed as the process of disinfection continues. At last a stage may be reached in which only one organism can be seen in five microscopic fields; the wound is then considered "sterile," and may safely be closed by secondary suture or strapping, with almost no risk of any latent sepsis. It has been found that if a wound is closed when the organisms are as numerous as one per field stitch abscesses are very liable to occur. In certain cases, *e.g.* osteomyelitis after severe compound fracture, some observers believe there is better callus formation if the wound is kept open for a long period, and in these cases the organisms may be found to be reduced to one in twenty microscopic fields or less.

The record (Fig. 4) of the number of organisms found—the "courbe microbienne"—is now largely used as an indication of the result of treatment, whether the Carrel-Dakin or other technique is employed. So long as the number of organisms steadily diminishes, treatment may be

considered satisfactory; but if the number remains stationary or increases, the cause of the arrest of disinfection should be sought, *e.g.* insufficient number of tubes, presence of sloughs, foreign bodies, pieces of clothing, faults in technique, etc.

MICROBIAL CURVE.

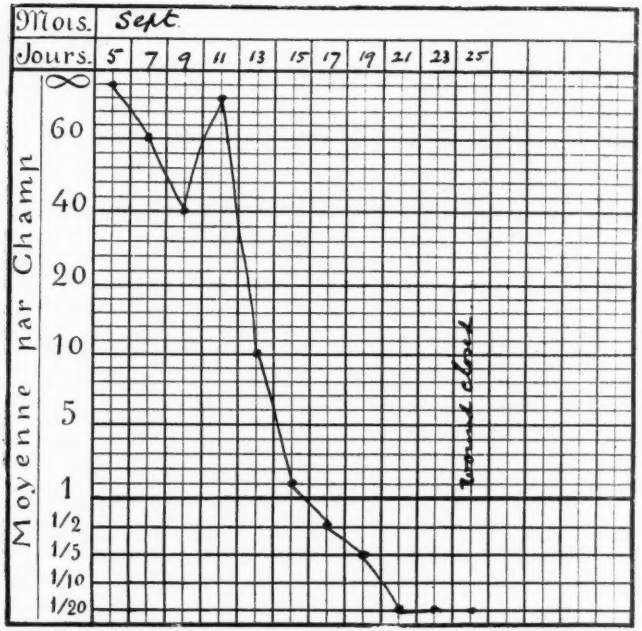

FIG. 4.

Chart showing the bacterial curve of a wound according to the number of organisms seen in a microscopic field. The symbol ∞ represents infinity. Below the line the figures show the number of fields examined to find one microbe (after Carrel).

General Remarks.—While it should be admitted that we owe a great deal of our knowledge of the physiology of wounds to Sir Almroth Wright, the results of the Carrel-Dakin treatment have abundantly proved the superiority of the antiseptic treatment of wounds over the treatment by

saline solution, normal or hypertonic. There are many ways of securing disinfection of wounds, but the method of Carrel seems one of the most satisfactory. On the other hand, there are difficulties in the preparation of the fluid in order to ensure the correct strength, and in connection with the necessity of flushing the wound every two hours, owing to the fact that the hypochlorite of soda so rapidly loses its antiseptic properties when in contact with the tissues. A solution of flavine (a dye of the acridine series) is so easily made of the strength of 1 in 1,000, and appears to act so particularly well in contact with serum, that it has been suggested that this solution might replace the Daufresne's solution in the Carrel technique. There are reasons for believing that the results will not be so satisfactory.

In order to obtain a more abiding antiseptic, and so obviate the necessity of frequently flushing the wound with the Daufresne's solution, experiments are being carried out with a view to perfecting a chloramine paste which at present is in use, of a strength of 1 per cent. of chloramine with a stearate of soda basis. The aromatic chloramines were found by Dakin while he was searching for an intermediate substance upon which he thought the antiseptic action of the hypochlorites depended. So far it may be said that chloramine paste, when applied to a wound, will check the further development of organisms in the wound for twenty-four or forty-eight hours, and is therefore useful for cases which must be transported. At Compiègne superficial wounds were often treated with chloramine paste, and the antiseptic power of the paste appeared to be only slightly inferior to that of the hypochlorite solution.

Possibly future improvements in wound treatment will be found to be associated with some form of paste or fluid, which allows of the continuance of its antiseptic properties for a considerable period, and so saves the labour and pain

necessitated by frequent dressings. Morison's bismuth and iodoform paste has already achieved highly satisfactory results, and Mencière uses an embalming fluid, for which he claims success in combating the infection of wounds as shown by the bacterial curve, in the same way as that already described for the Carrel-Dakin technique.

It is desirable to point out that Daufresne's solution should not be heated; it should not be used in the general peritoneal cavity, nor applied to the eye, and it should not be used intravenously as it is hæmolytic, and has thus caused death.

ACUTE PANCREATITIS, WITH SPECIAL REFERENCE TO ITS TREATMENT, AND A RECORD OF THREE CASES PRESENTING UNUSUAL FEATURES.

BY

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THE diagnosis of acute pancreatitis is but rarely made, for to most surgeons there has not seemed anything really distinctive in the group of symptoms and signs produced by the disease, and its discovery at the laparotomy or in the post-mortem room is generally a surprise. There have been a few cases correctly diagnosed, from time to time, but their proportion to the number of cases in which the diagnosis was not made is very small. Although Moynihan [1] seems justified in saying that although the number of cases that have been diagnosed before operation is extremely small, yet he is

[1] *Abdominal Operations*, 1914, ii. 397.

confident the symptoms are of such a character as to make recognition of the cause a matter of very little difficulty, for he has correctly diagnosed seven out of his last eight cases, yet the fact remains that the diagnosis has rarely been made by other surgeons. Out of a series of six cases reported from University College Hospital[1] by the late Mr. A. E. Barker, in which the patients were under the care of the surgeons of the hospital, one case was diagnosed as perforated gastric or duodenal ulcer, another as intestinal obstruction, while in another no diagnosis could be made. One of the cases was, however, correctly diagnosed by Mr. Raymond Johnson, but in this case the patient's condition was too bad to allow of operation.

The symptoms of acute pancreatitis were described by the American surgeon Fitz several years ago, and his description is quoted by Moynihan in the last edition of his book on *Abdominal Operations*. Within recent years the clinical aspect of the disease has also been very well described by the late Sir F. Eve in his Bradshaw Lecture on "Acute Pancreatitis" in 1915,[2] and by the late Mr. A. E. Barker,[3] and by Mr. Battle.[4] Reference to Fitz's original account or to these writings may with advantage be made for a description of the usual clinical aspect of the disease.

When the abdomen is opened the surgeon usually recognises the true nature of the case by the discovery of white areas of fat necrosis, each about the size of a pin's head, scattered through the subperitoneal fat and the omentum. It is of course well known that these areas of fat necrosis are due to disease of the pancreas, and hence the surgeon's attention is directed to it, and he generally finds it swollen and hemorrhagic, with perhaps some lymph exudation on it,

[1] *Lancet*, 1914, i. 1594. [2] *Ibid.*, 1915, i. 1. [3] *Ibid.*, 1914, i. 1594.
[4] *Ibid.*, 1911, i. 6.

and blood-stained fluid may be found in the lesser sac of the peritoneum, or even in the general peritoneal cavity.

Case 1 is of special interest from the fact that, although when the abdomen was opened the presence of fat necrosis called attention to the condition of the pancreas, yet when the lesser sac of the peritoneum had been opened by division of the gastro-colic omentum, no definitely abnormal condition of the pancreas could be discovered, nor was the pancreas found to be diseased post-mortem until it had been removed from the body, and then some lymph and hemorrhage was seen on its posterior aspect only; and on cutting into it some areas of slight hemorrhage and yellow infiltration were found. The morbid condition was almost confined to the middle of the organ, and although this was the part examined at the operation, none of these morbid changes could have been made out on inspection, or palpation of the presenting aspect of the organ, for they were only discoverable on its posterior aspect.

In Case 2 it is a very interesting and instructive fact that the vomit was fæcal. It is stated in a recent text-book of surgery that the vomit in acute pancreatitis is never fæcal. Certainly fæcal vomiting is most suggestive of obstruction, and was so in this case. The vomit both looked and smelt fæcal.

In Case 3 the great interest of the case was the apparent recovery of the patient after the acute stage. Serious symptoms, however, recurred, and led to a fatal termination. The patient had so far recovered from the acute stage, at the end of which she was admitted (which seemed probably due to the passage of gall-stones or their retention in the common duct), that I discussed with her the desirability of having an operation for removal of gall-stones before another attack came on, and yet at that time the acute pancreatitis must have been passing into the sloughing stage. Though

hemorrhagic, gangrenous, and suppurative pancreatitis are by some writers described as different forms of the disease, they are more frequently regarded as only different stages, for the condition of acute hemorrhagic pancreatitis is found to end in suppuration or gangrene in a certain number of cases. If the disease is present in its most severe form at the onset, very likely the patient will not survive to the gangrenous or suppurative stage, and it is of course quite possible that resolution of the acute stage may take place without either suppuration or gangrene.

The condition of temporary improvement after the acute stage of the disease was almost as marked in one of the six cases collected by the late Mr. Barker at University College,[1] as in my own case. After a very acute onset, and the discovery of acute pancreatitis at operation, by the third week there was "much general improvement, and the progress was generally favourable," and then, as in my case, symptoms recurred, and sloughs began to discharge through a drainage tube which had been introduced from the loin to the region behind the pancreas. In the second case recorded in this series there was also rapid improvement up to the eleventh day after draining the lesser peritoneal sac, and then symptoms recurred, and a collection of blood and pus had to be drained from the left side of the abdomen two days later.

In all three of my cases, as in other published cases, there was a history of recurrent attacks of pain in the upper abdomen. What was the nature of these attacks? They were not followed by jaundice. In one of the cases the gall-bladder contained a large stone, and in another many small stones, and in the third no stones were found in it, or in the common duct. It is unlikely that if the attacks in case No. 3, in which no stones were found in the gall-bladder, had been due to the passage of gall-stones, that every stone should have

[1] *Loc. cit.*

been passed before the onset of the fatal illness. Therefore, in this case at any rate, the recurrent attacks were probably not of the nature of gall-stone colic, and it is doubtful if they were in the other two.

Case 1.—A woman, E. P., aged 42, was seen in consultation with Dr. Cook at 1.30 p.m., Thursday, November 21st, 1907. Her illness began on the previous Sunday (the 17th), with pain across the upper abdomen and vomiting, and the pain had continued in the same position, but there had been only very occasional vomiting since the day of onset. The bowels had acted. For a fortnight before the onset of the marked abdominal pain on the 17th there had been slight pain in the same region. During the earlier part of the year she had had four attacks, in which Dr. Cook had attended her, and he thought they had all been similar to the present one. There had been no jaundice in any of them.

She was a very fat woman, and there were several inches of fat in the abdominal wall, but apart from this there was no marked distension of the abdomen. The upper half of the abdomen was very tender, and the tenderness was not only epigastric, but was present in each hypochondriac region, and was very marked in the right one. The lower abdomen seemed quite normal, and pelvic examination was negative. A little later in the afternoon after her admission to hospital her temperature was 101°, pulse 110 and of good strength, respiration 22. By that time the pain had increased

With the history of the attacks of pain in the upper abdomen, it seemed possible there might be some cholecystitis associated with gall-stones. I did not suspect the presence of acute pancreatitis. But her condition seemed serious enough to call for immediate operation, which I performed at 4 p.m. I opened the abdomen through the right semilunar line, and explored the gall-bladder. It contained a very large stone. Numerous areas of fat necrosis were seen in the omentum, which directed attention to the pancreas. This was exposed by another incision in the linea alba, with division of the gastro-colic omentum. When I had thus exposed the pancreas, I could not discover anything abnormal about it, nor any hemorrhage in the surrounding tissues. The day following the exploration she was free from abdominal pain, but suffered from frequent vomiting of dark fluid, and became collapsed and died at the end of twenty-four hours from the operation. The temperature fell to normal after the operation, and remained so until it rose to 101.6° again a few hours before death. Rectal and then subcutaneous saline had no very definitely beneficial effect.

At the post-mortem examination fat necrosis was found to

be very marked in the omentum, and in the subperitoneal fat in the region of the pancreas. Nothing abnormal could be made out in the condition of the pancreas until it had been removed from the body, and then some lymph exudation and hemorrhage was seen on the posterior surface. On making a section of the organ, an area of slight hemorrhage and purulent infiltration were discovered in the centre. The head and tail of the pancreas were almost free from the morbid process. The organ was not obviously enlarged, and the amount of hemorrhage was very slight, hardly more than blood-staining. Nothing abnormal could be seen on the anterior surface. No gall-stone was present in the common duct, and there was no pancreatic concretion.

Case 2.—A man, J. L., aged 58, was sent to me at the General Hospital by Dr. Lewis, of Winscombe, on March 28th, 1914. He had had attacks of pain in the right upper abdomen for four years, but not at frequent intervals. A year at one time, and six months at another, had intervened between the attacks. The last attack had been eight weeks before admission. There had been no jaundice after any of the attacks, and there was, when I examined him, no tinge of bile in the conjunctiva or urine. I could feel nothing of the gall-bladder, but he was tender in the middle line high up in the epigastrum. It was not evident that the attacks were of the nature of gall-stone colic, though this was suspected, and if they were, the attacks hardly seemed to occur often enough to call for operation, and he returned home. But two days after he returned home he was attacked by severe epigastric pain, and this continued. He vomited on the following day, but only once, and Dr. Lewis sent him into hospital again on the evening of the third day, *i.e.* on April 3rd. When I saw him at 11 a.m. on April 4th I found that distinct fæcal vomiting had set in since admission, and his pulse was 120 and feeble. There had been a slight liquid fæcal action and some gas passed as the result of an enema, but from the time of the onset of the pain to his admission enemata had failed to produce any action of the bowels. There was a very slight tinge of bile in the conjunctiva, and also in the urine. There was moderate distension of the abdomen, but this was almost confined to the upper part. It was not rigid, but the upper part was tense and hyper-resonant. There was no swelling anywhere, and rectal examination was negative. There was no rise of temperature. The quite marked fæcal character of the vomit very strongly suggested mechanical obstruction, and I wondered, taking into consideration the previous history, whether it might be obstruction by a gall-stone.

I operated at noon, after emptying the stomach of its fæcal contents. The abdomen was opened through the upper part

of the right rectus. There was a large quantity of brown serum in the general peritoneal cavity, especially in the right kidney pouch. Numerous minute areas of fat necrosis were present in the omentum and the sub-peritoneal fat, and the condition was confluent in the region of the head of the pancreas. The pancreas was considerably enlarged and very hard. No hemorrhage was seen. He was pulseless at the end of the operation, but the pulse returned after intravenous saline infusion with pituitary gland extract; he lived only for a few hours

At the post-mortem examination the pancreas was found to be greatly enlarged, and of a purple colour. There was a large area of hemorrhage in the centre, and the head and tail were of a pink colour and swollen. There was also hemorrhage into the surrounding tissue. There were many stones in the gall-bladder, and one very minute fragment of stone in the common duct. The upper part of the small intestine was distended with fluid right up to the duodeno-jejunal junction, but the lower part of the ileum was quite empty. There was no mechanical obstruction and no peritonitis. The fæcal vomiting was no doubt due to the distension of the upper part of the small intestine, but there was nothing to explain the cause of this distension.

Case 3.—A woman, J. W., aged 64, was admitted to hospital on Monday, December 11th, 1916, and seen by me that evening. During the six months before admission she had four attacks of epigastric pain passing through to the back, with vomiting, and each lasted some hours. The present illness had begun on Thursday, December 7th. like one of the other attacks, but the pain had persisted for four days, and the vomiting had been very frequent during that period. She had required one hypodermic injection of morphine for the pain on one of the four days. The bowels had not been open during the illness, and an enema after admission had had no result.

She was a very fat woman, and had a great thickness of fat in the abdominal wall, but the abdomen was not distended or rigid, and was only slightly tender in the epigastrium, and to the left of it. She had no abdominal pain. Pulse was 80 and quite good, and temperature 100°. When seen by daylight next morning it was doubtful if there was any bile-tinge in the conjunctiva. There was no definite bile reaction in the urine.

The bowels acted freely after hot turpentine enemata. The slight epigastric tenderness disappeared. She was at first fed by nutrients only, but there was no recurrence of any vomiting after admission. Her temperature was 100° the evening of the day after admission, and then quite normal for five days, and she seemed to be making quite a satisfactory recovery from what seemed probably a very prolonged attack of gall-stone colic, but

no stones could be found in the motions. But on the 16th the symptoms recurred. Abdominal pain and vomiting again set in, and the abdomen became tender and rigid. Her pulse was at first raised to 112, and later became very rapid and so feeble as to be uncountable, and she was very restless and wandering. The temperature was not at first raised, but at 2 p.m. on the 17th she had a rigor, and it ran up to 105°. There was a slight jaundiced tinge in the conjunctiva, but no bile in the urine. The rigor suggested to my mind the presence of stone in the common duct, or from the serious condition of the patient perhaps a portal infection. She had another rigor and temperature of 105° on the 18th, and after remaining below 100° on the 19th and 20th, she had a third rigor on the 21st, and the temperature again rose to 105°. But her condition very much improved after the 17th. The abdominal pain, tenderness and rigidity passed off, though she still vomited occasionally, and her pulse was greatly improved by subcutaneous saline infusion and fell to 70–80. Her condition seemed sufficiently improved to make an exploration for stone in the common duct desirable, though she was still very feeble, and her tongue very dry. The slight tinge of jaundice in the conjunctiva persisted. The repeated rigors, with a marked improvement in her condition, were even more suggestive of a stone in the common duct, for the improvement seemed to negative portal pyæmia.

I operated on December 24th. I did not find any stones in either the gall-bladder or common duct, but the head of the pancreas felt much enlarged. It was wrapped up in a mass of very fat omentum, and in the omentum were numerous areas of fat necrosis. I regarded the case as one of subacute or chronic pancreatitis, although fat necrosis was much more suggestive of the acute disease, and I drained the gall-bladder, and did not interfere with the pancreas itself. She was in very fair condition at the end of the operation, but she was very drowsy next day. Several times she vomited. An attempt was made by subcutaneous saline infusion to improve her failing pulse. The temperature ran up to 104.6° at 10 p.m. on the 25th, but there was no rigor. Bile was discharged freely from the tube in the gall-bladder. She died on the early morning of the 26th.

At the post-mortem examination, on drawing up the transverse meso-colon, and separating some coils of small intestine from its right side, near its root, a small cavity was opened, which contained necrotic tissue, and into it gas and liquid fæces welled up from the bottom. On further examination this cavity was found to lie over a gangrenous pancreas, with which it communicated. The whole central part of the pancreas was in a condition of greenish black pulp, and a large slough of pancreatic tissue represented the head, and was almost

detached, and another replaced the tail. The intestinal perforation was from necrosis of the duodenal wall, where it passed round the head of the pancreas. This necrosis was very extensive, and had caused a collection of fæcal matter to form in the left loin beneath the panceas. No stone was present in the common duct. There was no sign of peritonitis in the general peritoneal cavity, and no free fluid.

We must recognise the fact that sometimes, when nothing more is done than an exploratory laparotomy, a patient suffering from acute pancreatitis may recover. An instance of this has been recently published.[1] There is no reason to think the laparotomy in any way contributed to the patient's recovery, indeed it would rather tend to prevent it, but without any exploratory laparotomy it would hardly be possible to say that acute pancreatitis had been present in cases of recovery. It is, of course, quite possible that some cases of acute abdominal disease that recover without operation may be instances of acute pancreatitis.

I venture to think that all surgeons can do in acute pancreatitis is to provide drainage for exudation into the lesser sac of the peritoneum, or into the retro-peritoneal tissue around the pancreas. Inflammatory exudation into the lesser sac is of course drained through the abdominal incision, but suppuration and sloughing of the pancreas is obviously best drained from behind, though an anterior drainage tube passing through the peritoneal cavity is better than no drainage at all. But posterior drainage is rather a formidable undertaking in a patient so ill as one suffering from acute pancreatitis. As the pancreas extends much more to the left of the spine than the right, the drainage should be on left side, but in order to reach the pancreas there, we have to burrow from the loin through a region full of large vessels. If we study the anatomical relations of the pancreas, we find that the right place to burrow is between the upper part of

[1] *Brit. Med. Journ.*, March 17th, 1917, p. 359.

the left kidney and the spleen, through an incision below the last rib in the loin, and then as we work forwards we have the splenic vessels between our fingers and the pancreas. It would, I think, be very dangerous to burrow with even sinus forceps, which might tear the splenic vein, and the only safe way would be to work gently with the finger-tip. The late Mr. A. E. Barker made such an incision on the right side, but he had one hand in the abdomen to guide him, and he said "it was not as difficult as he expected." This case teaches us that when we establish such posterior drainage, it is well not to shorten the tube for some considerable time, for suppuration and sloughing may be late in their onset.

One difficulty in making a satisfactory posterior drainage opening in these cases, when the surgeon uses one hand on the anterior aspect of the pancreas in the abdominal cavity, as a guide to the other hand burrowing towards the pancreas from a posterior incision, is that the skin of the loin is not prepared for operation, as the disease is probably only discovered as the result of the laparotomy, and it would be a very undesirable proceeding to operate from behind through unprepared skin with the peritoneal cavity open. And another difficulty is that with the opened abdomen, the patient must of course be rolled on the side to get at the loin. I think the best plan to meet both these difficulties is to close temporarily the abdominal incision, and cover it with a sterile towel; then roll the patient over on to the side, and prepare the skin of the loin with some rapid method such as cleaning the skin, and then applying eusol or iodine, after first drying it with spirit; then to make the loin incision and burrow in the direction of the pancreas, and then when we imagine that it is nearly approached turn the patient partly on the back again, open up the abdominal wound, and then insert the fingers of the left hand on to the pancreas, as a guide to the burrowing finger of the other hand in the loin

wound. If the patient is too bad to stand this somewhat complicated operation, we must be content with anterior drainage by leaving a large drainage tube reaching from the abdominal wall down to the pancreas, but should establish posterior drainage at a later date, before sloughs begin to separate, unless the symptoms subside completely after the anterior drainage, but we must remember that a period of apparent recovery may mislead us, as it did in Case 3.

Incision into the pancreas is recommended in these cases of acute pancreatitis, either in the form of small incisions or multiple punctures, but it seems to me that though such incisions or punctures may certainly relieve tension, and allow of the escape of inflammatory exudation, yet if they are going to act efficiently in this way the incisions must go deeply into the gland, and that would involve considerable risk from hemorrhage. The late Mr. A. E. Barker, in speaking of incision of the pancreas, said " it seemed risky to incise the swollen area, and allow the inflammatory products to escape into the peritoneal cavity and drain through it," and his case recovered with posterior drainage alone. In the other successful cases of Mr. Barker's series,[1] the pancreas was not incised.

In Cases 1 and 2 drainage, or incision into the gland, would not have saved the patients' lives. In Case 3 drainage might have done good, but at the time I operated the toxæmia was too profound and too quickly fatal to make it at all probable that it would have led to the patient's recovery. When I was able to determine that a lesion of the pancreas was present in this case, from the finding of the fat necrosis and the swollen condition of the head of the pancreas, I had no knowledge of the extensive gangrene which was discovered at the post-mortem examination. I seemed to me most likely that the pancreatitis was subacute, and associated with an undiscoverable stone in the common

[1] *Loc. cit.*

duct, to the presence of which the signs had been due. Perhaps it is as well that I did not further explore the condition of the pancreas by opening through the very fat-laden gastro-colic omentum, for I should by so doing probably have disturbed the adhesion of the coil of small intestine to the under aspect of the transverse meso-colon, and thus have infected, perhaps without discovering it, the general peritoneal cavity.

It is suggested that if in operating on a case of acute pancreatitis gall-stones can be felt in the gall-bladder, they should be removed and the gall-bladder drained, if it does not too seriously prolong the operation. Unless we had evidence that the removal was almost essential to the patient's recovery, it seems to me that we should not prolong the operation by removing gall-stones or draining the gall-bladder. It is not the presence of stones in the gall-bladder, but stones in the common duct which is likely to cause pancreatitis, and even if we discover one there, in the presence of this acute and dangerous disease its removal could hardly be wisely undertaken at that time. In Case 3 I drained the gall-bladder because I did not realise how advanced and serious was the pancreatic disease, and it is only indicated in the less serious and more chronic form of the disease.

RECTAL DIVERTICULA AS A CAUSATIVE FACTOR IN PELVIC INFLAMMATION IN WOMEN.

BY

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THE importance of diverticula of the lower part of the large intestine as a factor in the production of general or localised peritonitis was once again emphasised when in 1908

Maxwell Telling published a paper[1] giving an account of over a hundred cases, the records of which he had collected. The great majority of Telling's cases dealt with diverticula of the sigmoid and descending colon ; but in the course of his paper he drew attention to the fact that the same effects were produced by diverticula of that part of the rectum which is covered with peritoneum.

In 1910 Cameron and Rippmann[2] published a paper, giving an account of the post-mortem findings in five cases of death from general peritonitis or localised inflammation in which, at the autopsy, no lesion could be found excepting a perforated or inflamed diverticulum.

Telling points out that the following affections may be caused by diverticula :—

1. General infective peritonitis from perforation.
2. Acute or gangrenous inflammation (acute diverticulitis).
3. Chronic proliferative inflammation with stenosis of the intestine.
4. Adhesions, especially to (*a*) small intestine, (*b*) bladder.
5. Perforation with (*a*) general peritonitis, (*b*) local abscess, (*c*) sub-mucous fistula, (*d*) fistula into bladder or other hollow viscera.
6. Impaction of foreign bodies, *e.g.* a fishbone (as in a case recorded by Cameron).
7. Inflammation of the sigmoid mesentery.
8. Metastatic suppuration.
9. Local peritonitis.
10. Development of malignant disease.
11. Perforation into a hernial sac.

In several of the cases recorded by Telling and Cameron and Rippmann the symptoms were attributed to appendicitis, but in no instance was any abnormality of this structure found.

[1] *Lancet*, March 21st. [2] Guy's Hospital Reports.

As these diverticula are actual hernial openings in the wall of the intestine at the points of attachment of the appendices epiploicæ with protrusion of the mucous membrane, and as they occur for the most part in the lower part of the intestine, and very commonly contain concretions of solid fæcal matter, the risks which they cause hardly need explanation.

The relative frequency of the different occurrences mentioned by Telling are approximately as follows :—

In Telling's paper rather more than one-third of the cases dealt with resulted in perforation, a rather larger number resulted in the formation of more or less dense adhesions. Of the remaining cases, about equal numbers suffered from one or other of the affections mentioned in his list.

Practically all the results which Telling and Cameron have observed in cases of diverticula of the sigmoid can occur in cases where diverticula are situated in the upper part of the rectum.

In addition to the pathological conditions already described, mistakes in diagnosis may be caused by the presence of diverticula when acute or sub-acute symptoms are absent altogether, *e.g.* the nodular sensation imparted to the examining finger may lead to their being mistaken for a new growth possibly of a malignant nature.

The first case which I am about to describe is an example of such a mistake in diagnosis, the second of my cases is one in which perforation occurred with the formation of a fistulous opening into the bladder.

These diverticula are seldom found in women below middle age, but are fairly common in the aged. No treatment is likely to be successful ; medicine does not affect them, and their operative removal, seeing that they are generally multiple, means a tedious, difficult, and dangerous operation.

Case 1.—A multipara, aged 51, was sent to me for diagnosis by her own medical man, who was of opinion that she had a malignant growth of the intraperitoneal portion of the rectum. As I was unable to give a definite opinion without a laparotomy, the abdomen was opened in the middle line, and the nodules felt on vaginal and rectal examination examined. These were seen to be diverticula occurring in the appendices epiploicæ of the rectum, which contained hard nodules. One was removed for the purpose of more detailed examination. Its stalk was ligatured, and inverted into the rectum by means of a purse-string suture. On cutting into the appendix epiploica, it was found to contain a hard concretion of fæcal matter, and the nature of the nodules sufficiently demonstrated.

Case 2 was an unmarried woman, aged 56, who had consulted me at intervals during the previous ten years on account of a fibroid growing from the posterior wall of the uterus, presenting the usual symptoms, but for which operative treatment was not advised, as the growth did not enlarge, and latterly showed definite signs of diminishing. She now consulted me on account of pain in the region of the bladder and frequent micturition, with the added complaint that she not infrequently passed flatus through the urethra.

The urine contained pus, was extremely offensive, and gave a plentiful growth of bacillus coli; minute pieces of fæcal matter were occasionally, but not frequently, found.

On examination a mass was felt on the posterior wall of the uterus, which was supposed to be the remains of the fibroid, much diminished in size. A diagnosis was made of an adherent rectal diverticulum, which had perforated into the bladder. As local treatment of the bladder only partially ameliorated her symptoms, and was ineffectual in producing permanent cure, it was decided to deal with the condition after laparotomy. When the abdomen was opened, it was found that a rectal diverticulum was densely adherent to the fundus of the bladder above the fundus of the uterus. This was separated, the pedicle of the diverticulum ligatured, and its stalk invaginated into the rectum by means of a purse-string suture. The perforation into the bladder was inverted by a purse-string suture, with a second row of interrupted sutures for additional security. The patient made an uneventful recovery, excepting that some suppuration occurred, and a fæcal fistula through the abdominal wall eventually developed. Her bladder symptoms cleared up almost at once, but the fistula remained. This gradually contracted until, although it did not completely heal, it gave her very little trouble. Owing to her condition (she was an absolute cripple from rheumatoid arthritis), it was not considered advisable to do a second operation to close the fistula. At the operation the remains of the fibroid were found

to be reduced to about the size of the half of a large walnut, but covered by adhesions produced by inflammation of the diverticulum, which had made its size appear very much larger.

The points on which the diagnosis rested were these: it was obvious that there was a communication between the bladder and the intestine; it also appeared obvious that this connection was not with a part of the intestine, of which the contents are fluid under normal conditions. A communication with the small intestine possibly through a persistent diverticulum of Meckel was thus excluded. The possibility of a communication between the appendix and the bladder was considered, but here again fluid fæcal matter would have been present and probably persistent, and the patient had at no time presented symptoms which suggested any inflammation of that structure. The lower part of the large intestine, therefore, seemed to be the most probable site of the communication, and it was suggested that this was possibly due to an inflamed adherent diverticulum, which at the operation proved to be the case.

Other cases which I am unable to cite in detail have come under my notice. In one the opening of a pelvic abscess containing fæcal smelling pus resulted in a fæcal fistula both through the vagina and abdominal wall. In another the opening in the hypogastrium of a superficial abscess of the abdominal wall revealed a track leading into the pelvis. In this case also a fæcal fistula from the abdominal opening impinged on the rectal wall below the promontory of the sacrum, easily felt by the finger when strong pressure was made upwards, in the posterior fornix of the vagina. In both of these cases the origin of the suppuration was probably an inflamed diverticulum.

That the presence of these diverticula may be the cause of inflammation in the pelvis should not be forgotten, nor the fact that they may present appearances similar to those of malignant disease.

Reviews of Books.

Medical Lectures and Clinical Aphorisms. By SAMUEL GEE, M.D., with Recollections by J. WICKHAM LEGG. Pp. viii. 392. Oxford Medical Publications. 1915. Price 6s. net.

In this work we have what in a former generation would have been termed "the remains" of a clinical observer and teacher, who was certainly not surpassed in the fields of observation and teaching by any one of his many distinguished contemporaries. All his writings, which are unfortunately few, are characterised by sound judgment, learning, and breadth of view. From them we can gather somewhat of the privilege it must have been to have been taught clinical medicine by such a master of the art. His writings show that his teaching was of the kind that provokes thought, and stimulates his hearers to further investigation.

This book consists of several lectures, his clinical aphorisms, and three extremely interesting essays on "Sects in Medicine," "The Conflict of Medicine with Small Pox," and on "Abraham Cowley." Dr. Wickham Legg adds his Recollections, which practically amount to a short biography and appreciation of the author, and helps the reader greatly in understanding what manner of man he was.

Of these various parts we take Dr. Wickham Legg's biographical sketch and the Clinical Aphorisms as likely to be of most permanent value. The one gives us a picture of a remarkable man of whom posterity will certainly want to know all that it can, and the other is the essence of the observations of one of the most acute observers at a great period in medicine. In reading these aphorisms we are struck with several instances in which the statements made are now common knowledge, and others in which Gee anticipated, and has been confirmed by later investigations, carried out by methods then unknown. It is given to few to be able to write aphorisms which stand the test of time and change; we think that the majority of these will do so. In conclusion, this is a book which every lover of medicine should have on his shelves, and we should place it side by side with that too little known work of another distinguished physician, a little antecedent to Gee, Moxon's *Pilocereus Senilis*.

Diseases of the Nervous System. By H. CAMPBELL THOMSON, M.D., F.R.C.P. Second Edition, revised and enlarged. Cassell & Co. Ltd., London, New York, etc. 1915.

Of the smaller text-books on nervous diseases this is one of the best, and students and practitioners have found that they have in it a useful guide to this difficult branch of medicine. A second edition has been called for, the original work has therefore been revised and enlarged, and in part remodelled. Thus the recent investigations into Syphilis of the Nervous System have necessitated a reconstruction of this section. New chapters on the General Functions of the Brain, on the applications of the methods of Experimental Psychology to Clinical Work, and on the Sympathetic System have been added. The book retains the features of clearness, accuracy, and brevity which gained for it a favourable reception on its first appearance. and it has been extended and brought thoroughly up to date, so that it may be taken as a trustworthy guide. There are many good illustrations. It has always seemed to us that in the smaller manuals or text-books the very rare diseases might be left out, as from exigencies of space the descriptions are of necessity too brief to aid the practitioner to recognise them. For diseases of which the ordinary man will probably never see a case or only one in a life-time, he might well be referred to the large treatises.

Medical Diseases of the War. By ARTHUR F. HURST, M.A., M.D. Oxon., F.R.C.P. Pp. 151. London: E. Arnold. 1917. Price 6s. net.

This is a most useful book, especially for those who have the care of invalid soldiers. It gives a summary of the most recent knowledge on such subjects as shell shock, dysentery, the para-typhoids and trench fever, soldier's heart, war nephritis, and gas poisoning.

The author shows, for instance, how important auto-suggestion is in the production of the various symptoms of shell shock. The attention of the patient as he recovers consciousness being fixed on one of the functions, such as speech or movement of an arm which was returning more slowly than others, he becomes convinced that it is permanently lost, with the result that a real hysterical paralysis takes place. The analysis of the various symptoms is excellently detailed, and the author reports a large number of cases of successful treatment

by hypnotic suggestion. Other elements in the causation of the symptoms, such as minute hemorrhages due to monoxide poisoning from cordite, and compression of the air from high explosives, are also considered.

The sections on gas poisoning and war nephritis are too short, but the author points out the practical distinction in the latter disease from acute exacerbations of old renal disease, viz., the absence of circulatory and retinal changes, and notes the low mortality and tendency to complete recovery, in spite of the frequency of severe uræmic convulsions.

On the question of the so-called soldier's heart, the origin is referred in many cases to bacterial intoxication after slight illnesses, in others to hyperactivity of the thyroid and the other ductless glands, and in some to excessive smoking. It is important that the man should not consider himself a sufferer from heart disease, and anyone with experience in Medical Boards knows the number of cases labelled valvular disease who come up after a time of rest with no trace of murmur or other abnormality left.

The chapters on dysenteries and para-typhoids are excellent, and contain many references to recent papers. The author distinguishes the two forms of epidemic jaundice, viz. the spirochetal and the catarrhal, and denies any direct connection between the latter disease and dysentery or mild para-typhoid, to which it has been ascribed by others.

Lead Poisoning, from the Industrial, Medical, and Social Points of View. By Sir THOMAS OLIVER, M.A., M.D., F.R.C.P. Pp. viii. 294. London: H. K. Lewis, 1914. Price 5s. net.

These lectures, delivered at the Royal Institute of Public Health, are a singularly interesting account by the first authority on the subject of the way in which lead gains entrance to the human body in various trade processes, the effects of the metal on the organism, and how these effects may be got rid of. We are shown too how the dangers have been lessened by legislative measures and inspection, and the actual Factory and Workshop Orders in force are given in an appendix. Dust appears to be the most common source of plumbism, but even in this form the lead gets chiefly into the alimentary canal rather than into the lungs. The author does not regard the presence of basophilia in the stained blood as a reliable test, in spite of the great claims made for it, and he discusses with much care the evidence

for the Wasserman reaction, which has been found in some cases of plumbism, and especially where pseudo-general paralysis exists, bnt the question does not appear to be finally settled.

Another interesting discussion too is that as to the effect of lead on the blood pressure. It appears to be certain that in those who have long worked in lead, there is a general tendency towards a rise above the normal and consequent risk of cerebral hemorrhage, but this does not occur as a rule in the earlier years of their work, while in acute poisoning there is often a great fall from the action of lead on the heart.

A very difficult question arises as to what constitutes lead poisoning from the legal point of view. Thus lead may be present in the body without causing any symptoms, just as a typhoid carrier may be in perfect health. The presence of lead in the urine is a reliable proof that it exists in the organism and is being eliminated, but the patient may show no ill-effects until some check to elimination suddenly produces serious symptoms. Are such persons suffering from lead poisoning before the paralysis occurs? Again, how can we decide whether gout or contracted kidney is or is not due to employment in lead work ?

In the chapter on treatment we find actual proof of the removal of lead from the organism by the double electric (galvanic current) bath. This is shown both by the measurement of the quantity of lead actually removed, and by the practical effect in stopping paralysis and colic.

Treatment of Neurasthenia. By Dr. PAUL HARTENBERG, translated by Dr. E. PLAYFAIR. Oxford Medical Publications. 1914. Pp. 283. Price 6s. net.

The reader will find in this book a clear and detailed description of the clinical features of Neurasthenia, based upon the author's evidently large experience of the disease. The book follows the ordinary lines. A large part of it is taken up by the chapters on treatment. The author finds in strychnine, given in full doses, preferably subcutaneously and also by the mouth, the most valuable drug. In this respect he differs from those who find that strychnine is not well borne by most neurasthenics. In general the observations on treatment are marked by sound sense, and will be found of great value by anyone who has to deal with these patients, and help him to bring his cases to a successful termination. It is in our opinion a mistake to publish a book of this size without an index.

Military Surgery. By DUNLOP PEARLY PENHALLOW, S.B., M.D. (Hart.). Pp. xiv. 432. Oxford Medical Publications. 1916. Price 15s. net.

This is an interesting book on war surgery, but it is by no means an exhaustive treatise on the subject. If we turn to any particular subject, we are apt to feel disappointment at the extent of the information given about it. There seems so much more that might have been written with advantage, and here and there we feel strongly disinclined to agree with what the author does state. Take as an example of incomplete information the subject of injuries of blood vessels and aneurysm. There is no reference in the list of recent literature consulted to either Sir Wm. Makin's very valuable contribution on "The vascular lesions produced by gun-shot injuries, and their results" (*British Journal of Surgery*, January, 1916), or to the very valuable collection of records of traumatic aneurysms published in earlier numbers of this journal. However, many quite interesting and instructive cases are related; and the illustrations of cases, and the use of apparatus, and the reproduction of skiagrams are very good and helpful.

The chief interest of this book seems to us to be the experience of the author in plating gun-shot fractures. This has so often proved disastrous, that it has been very strongly condemned. It has been the experience of surgeons who have used this method in gun-shot fractures that very extensive necrosis was caused by it. Perhaps this has been due to the enormous plates and long screws we have seen provided as a part of army surgical equipment. As the author points out, a certain amount of necrosis is very apt to follow suppurating gun-shot fractures which are not plated, and he does not think plating materially increases the likelihood of this. His results seem certainly to justify his practice, and appear to us sufficient reason for a wider adoption of it. He has plated fifteen cases "with no failures and with excellent functional results." He lays great stress on the need for providing drainage of the medullary cavity of the plated bone, and he removes the plate as soon as union takes place. Several instructive cases are given illustrating the treatment, and some important matters, in the technique, besides drainage of the medulla, are referred to. The advantage of fixing fragments, which are difficult to bring in position, in this way is sufficiently obvious to make the method very acceptable to the military surgeon, if it is not followed by the disastrous consequences of which surgeons have been afraid We note that the author recommends constant irrigation with Eusol or saline after the operation, until the infection clears up. But the recent results of Carrel and other surgeons abroad, who

have adopted his method of sterilising wounds, have been so excellent, that these surgeons have been able to plate gun-shot fractures thus sterilised with the best results.

We are disappointed with the author's description of the treatment of gun-shot fractures of the knee-joint. He is helpful in his account of the best method of dealing with the recent wounds, as based on the experience of Col. Gray and Capt. Lockwood, but we get almost no information as to how to deal with serious infection of the joint, which is one of the most disastrous conditions met with in military surgery, and demands prompt and energetic treatment, nor is the question of primary amputation considered.

His book is quite worth reading, but it can hardly be used as a work of reference to be consulted for help in dealing with difficult cases of military surgery.

Cancer, its Cause and Treatment. By L. DUNCAN BULKLEY, A.M., M.D., Senior Physician, the New York Skin and Cancer Hospital, etc. Pp. 230. New York: Paul B. Hoeber. 1915. Price, $1.50 net.

This book contains six lectures "delivered to practising physicians at the New York Skin and Cancer Hospital." The author's main arguments may be briefly stated thus:—As civilisation increases, cancer becomes more prevalent; amongst uncivilised tribes, such as the aborigines of Australia it is very rare, and it is uncommon amongst vegetarians, and amongst those nations which lead a simple life. The causes of cancer are unknown, but by a process of exclusion we may conclude that the main cause is a faulty metabolism; "malignant disease is but an aberrant action of originally normal body cells." Therefore, the treatment should be medical as well as surgical; correct the faulty metabolism by trying to improve the general health, especially by diminishing the amount of meat that is eaten. He inculcates a "perfect vegetarian diet, which includes even the exclusion of eggs and milk, with food."

He afterwards, however, modifies this statement, and allows the yolk of eggs and some milk. Under this treatment he claims that cases of inoperable cancer may be improved, and some cases may be cured. He does not condemn removal of the growth; "personally," he writes, "I am occasionally advising this in proper cases" (p. 145). Apparently he believes in local applications, and goes so far as to say: "I have seen the lump vanish under the continued application of the iodide of lead in Hebra's Diachylon Ointment."

It is when he cites figures and actual cases that the falsity of his speculations, and their danger, become apparent. He takes ninety-six cases of so called cancer of the breast, the average duration of the disease in each being one to six years. He owns that in the large majority the diagnosis rested on clinical evidence only, and describes how in four of them the tumour disappeared. In none of these four is there any mention of retraction of the nipple. Three other cases improved under dieting, but in two of these X-rays were used.

As the diagnosis of malignant disease of the breast is obviously uncertain in a large number of cases, without the additional knowledge gained by microscopical examination, the practical surgeon will not consider Dr. Bulkley's contention as proven, and we cannot but regret that arguments should be used which could deter medical men and patients from the only safe course at present known to science—the early and complete removal of malignant tumours of any kind, wherever this is possible.

The Pathology of Tumours. By E. H. KETTLE, M.D., B.Sc. Pp. viii. 224. London: H. K. Lewis & Co. Ltd. 1916. Price 10s. 6d. net.

This is a very lucid and instructive book, and informs us as to the recent developments of the knowledge of the pathology of tumours. Throughout the book are very clear and beautiful drawings of the histology of tumours, and these constitute a marked feature of the work, and are very helpful. Some of the illustrations of tumours in museum jars are not clear, and might well have been omitted, but there are several pictures of the naked-eye appearance of tumours which are excellent.

Although the author says he has consulted standard text-books, special monographs, and articles in various scientific journals, he has purposely refrained from giving reference to the literature. This we regret, as it is always an advantage for the reader to be able to turn to writings of other authors on a subject in which he is interested. Perhaps the author of the book may add references to the literature in the next edition.

The chapter on the experimental study of cancer is particularly interesting and instructive, and gives very clearly the result of the transmission of cancer by inoculation in the mouse, and the lessons to be learnt from it.

In describing the characters of a tumour which may be regarded as indications of its malignancy, we think the author

includes what we should regard as the essential characters of a malignant growth, such as a tendency to infiltrate, dissemination in glands, and other parts, and recurrence, when so far as the surgeon can judge by the naked eye he has completely removed it; but he also includes other characters, which though often present in malignant growths we should hardly regard as characteristic, such as ulceration, power of continuous growth, rapidity of growth, and tendency to central degeneration. These conditions might be also present in an innocent tumour. With regard to ulceration, it is admitted that it may be present in innocent tumours, and absent in malignant ones. Then why give it amongst the "accepted signs of malignancy"? And it certainly seems to us that it would not be wise to regard a tumour with central degeneration as necessarily malignant. As torapidity of growth being an accepted sign of malignancy, we must say we have seen some tumours, histologically quite innocent, grow rapidly, though of course rapidity of growth strongly suggests malignancy. Exactly what the author means by "power of continuous growth" is not evident, for obviously any innocent tumour has what we should usually understand by this. Possibly the author means power of continuous growth on transplantation.

The chapter on "Treatment" seems quite out of place in a book on the pathology of tumours, though it might be necessary to consider to some extent the pathology of tumours in a book on their treatment. But in this chapter there are some very interesting and instructive remarks by the author on the diagnosis of the nature of a tumour by immediate microscopic examination. The question as to what help the surgeon may really expect from the pathologist in this way is well considered, and the difficulty in making an immediate histological diagnosis, in some cases, is clearly set forth.

The very interesting and much discussed question of the transference of innocent into malignant growths is briefly considered from the pathological aspect, which is, we think, the only aspect which can afford conclusive evidence. The author considers that this transference is proved beyond all doubt from his own histological investigations. In connection with this subject, he makes the exceedingly interesting statement that he has found secondary malignant growths in an adenoma of the thyroid gland.

In the account of glioma we notice an unfortunate contradiction of the author's own information. He first says "gliomata are found only in the central nervous system and its out-growths, and the great majority occur in the brain." This seems quite definite, but on the next page we read that they occur outside the central nervous system, and "may grow in

connection with the retina or the medulla of the suprarenal gland."

Amongst the innocent tumours of bone, we think cysts should find a place, as so much recent knowledge about them has now accumulated, and some information should be given as to their relation to so-called "osteitis fibrosis."

We feel obliged to point out some defects and omissions, but we can strongly recommend this book as a guide to the pathology of tumours.

Manual of Surgery. By ALEXIS THOMSON and ALEXANDER MILES. Fifth Edition. Vol. I. Pp. xix, 801. Vol. II. Pp. xvi, 948. London: Oxford Medical Publications, 1915. We have so frequently had occasion to speak in favourable terms of this manual that it seems superfluous to make any further comment in this direction. Another edition speaks for itself. In this fifth edition, as in all previous ones, various sections have been almost entirely rewritten, and new material added to bring the work up to date. After the fourth edition a companion volume was added dealing with operative surgery, and the deletion of this part from the other volume has enabled much new material to be added without appreciable increase in their size. Such increase as there is in the second volume is due largely to an addition in the number of plates. The space given to them is well expended.

Surgical Contributions. By RUTHERFORD MORISON. Vol. I.—General Surgery. Vol. II.—Abdominal Surgery. Messrs. J. Wright & Co.—These volumes are a collection of the total surgical contributions of their distinguished author to various journals from 1881 to 1916. They are charmingly written, and full of ripe surgical wisdom and experience. The contents are very various—technical articles on diagnosis and treatment, reviews of books, statistics of cases, accounts of trips to American clinics, and tables of aphorisms all find a place. The illustrations are numerous and excellent.

The Mortality from Cancer throughout the World.—By FREDERICK L. HOFFMAN, LL.D. Pp. 826. The Prudential Press, New Jersey, 1915.—This is an exhaustive work containing statistics bearing on all aspects of cancer, its mortality, its relations to other diseases, its possible causes, even on cancer houses, and cancer villages. The amount of labour expended in compiling the statistics must have been enormous, and they are no doubt of great value in connection with various theories about cancer. Cancer as a problem in life insurance is very

carefully considered. Indeed, the book is written by the Statistician to the Prudential Insurance Co. of America.

Cleft Palate and Hare Lip. By SIR W. ARBUTHNOT LANE, Bart., M.S., F.R.C.S. Third Edition. Pp. 102. London: Adlard and Son, 1916. Price, 10s. net.—In reviewing the new edition of Sir W. Arbuthnot Lane's well-known book, it is not necessary to consider the question whether operation for cleft palate should be undertaken in infancy or deferred until early childhood, as the matter has been discussed at great length, and opinion on the subject is much divided. All Sir Arbuthnot Lane's methods of operating are clearly described, and illustrated by many helpful drawings. But to this new edition is added a very valuable chapter by Mr. Cortlandt MacMahon, who is instructor of speech defects at St. Bartholomew's Hospital, on the treatment of the speech defects which are associated with the cleft palate, and which require some careful and prolonged correction, after the cleft in the palate has been closed. This new edition has also a chapter by Mr. Maude James, on the means by which the teeth are restored to their normal position and function. Mr. Maude James has a large experience of the treatment of such cases at Great Ormond Street Children's Hospital.

A Code of Rules for the Prevention of Infectious Diseases in Schools. Issued by the Medical Officer's of Schools Association. Seventh Edition. Pp. 32. London: J. &. A. Churchill, 1915. (Price, 1s. net.)—This useful booklet has now reached its seventh edition since thirty years ago when the first edition was published. It is most essential that there should be a standard of uniformity in the various schools of the country, and this code has become quite the standard to be consulted on occasion. It has been carefully revised, but little alteration has been needful, excepting as regards Diphtheria, the rules for which disease have been altered so as to eliminite as far as possible the spread of this disease by "carrier." Now that cerebro-spinal fever has been by no means rare in schools and camps, we think it time that Rules for the detection and treatment of the carrier of the meningococcus should be included in the next edition.

Index-Catalogue of the Library of the Surgeon-General's Office, United States Army. Authors and Subjects. Second series. Vol. XXI., Waterworth—Vysman. Washington: Government Printing Office, 1916. Pp. 457 and 233.—This volume brings the present series to a close, and the librarian presents an interesting historical summary of the inception of the work and the growth of the library to which it refers. To Dr. John S. Billings, the creator of the Index-Catalogue and

to Dr. Robert Fletcher most of the credit for the work is due, and they and their collaborators have placed the medical profession under a deep debt of gratitude. The extent of their labours is shown in part by the statement that the library now contains a total of 224,552 volumes and 337,120 pamphlets, in all 561,642 items (volumes and pamphlets). The wideness of their research is also shown by the fact that the list of abbreviations of titles of medical periodicals employed in the second series of the Index-Catalogue occupies 233 pages of the present volume. The work is indispensable, and the publication of the third series will be welcomed by all interested in medical literature.

A War Cookery Book for the Sick and Wounded. By JESSIE M. LAURIE. Pp. 60. London: T. Werner Laurie Ltd. N.D. 6d. net.—The suggestions in this booklet are invaluable; they are simple and not too extravagant, also their variety is a great asset, as it is often so difficult to think of appetising dishes which may be eaten by invalids. At the same time, we think that in a large military hospital the recipes would not come under the War Office regulation diet. A little more explanation with regard to Benger's Food, and a note to say that it should be left standing for fifteen minutes for digestive processes to go on, and then boiled, would be an advantage for the Red Cross Nurse to know. All ladies who are tending the sick and wounded may be recommended to supply themselves at once with this cookery book.

Editorial Notes.

HEARTY congratulations to **Captain Alfred G. T. Fisher,** R.A.M.C. (T.) on his winning the Military Cross for services in the field. Captain Fisher is the second son of Canon Fisher, Vicar of St. Francis, Ashton Gate, and is Demonstrator of Anatomy in the University of Bristol.

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Major W. C. Swayne, who contributes an original article to this issue of the *Journal*, deservedly received a warm welcome on his resuming his work as Professor of Obstetric Medicine at the University and Obstetric Physician at the Bristol Royal Infirmary. Though he has been hard at work again in our midst for over six months, his good services in connection with the R.F.A. battery, and later as O.C. of a New Zealand battery on Salisbury Plain, will always be remembered.

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Food at School Ages.

THE Medical Officer of Health for Bristol, Lieut.-Col. Davies, sends us the following notes, which it will be felt are worthy of careful note. Recent experience in revising the dietary of an Institution for growing boys—from 12 to 16—has warned me that considerable, perhaps lifelong, injury might be caused to growing boys and girls at these ages by misapplied enthusiasm in the direction of food saving. This period of life is, as Burney Yeo points out, " one of the most critical and important epochs in the life of the individual as regards sufficient and adequate nutrition ; it is a time of active

growth and development, both physical and intellectual, and it is a time when any serious check to the perfect and complete evolution of the organs and functions of the body may lead to ineradicable mischief, and severely handicap the individual in the subsequent 'struggle for existence.'" Especially, one may add, as the prospective parents of the race.

Pamphlet No. 7, published by the Ministry of Food, points out: "Children need plentiful food for three reasons; their surface is large compared to their weight, they are growing, and they are generally very active. A child of eight needs half as much as a grown-up, a child of twelve three-fifths as much. A girl of sixteen needs as much as her mother, and a boy of sixteen may eat as much as his father."

The number of calories (heat units) that should be supplied daily by the food taken is laid down thus (Pamphlet No. 7):—

	Calories.
"Men, sedentary, and boys over 16	2,500—2,800
Women, in business, and girls over 13	2,000—2,200

A tall, thin person will need 200 or 300 calories more than a plump person."

If children of school ages are rationed, Managers and Medical Officers should see that the necessary number of heat units are supplied by the food. The Ministry of Food Pamphlet No. 7 (*National Rations and how to supplement them*, by Dr. Spriggs) gives a table which renders the calculation of dietary values absolutely simple.

The Ministry of Food never intended to stint the food of growing adolescents. Elder children are an exception to the four-pound ration. In a written reply to Mr. Duncan Millar, Captain Bathurst supplies the following table of what is considered sufficient weekly ration of bread, meat, and sugar for growing children:—

	Bread.	*Meat.*	*Sugar.*
Under 10	3 lbs.	1¼ lbs.	½ lb.
10—12	4 lbs.	2 lbs.	½ lb.
13—18	5 lbs.	2½ lbs.	½ lb.

Finally, to quote the Ministry of Food Pamphlet No. 21: "Everyone will agree that the greatest care must be taken to give our children the food they need, whoever else goes short. Upon them will lie the duty of holding what has been won by the blood of the brave. They must be fit in body and mind to make peace more glorious than war by the right use of our dear-bought freedom."

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Lieut.-Col. Prowse, O.C. 2nd Southern General Hospital.

In the absence on duty in France of Colonel Bush, C.M.G., the command of the 2nd Southern General Hospital has been conferred on Lieut.-Col. Prowse, who is Senior Physician to the Bristol Royal Infirmary. Long before the war broke out he had been recognised as an able administrator by those who knew him in private life, and Lieut.-Col. Prowse's exceptional capabilities in this direction had already proved so invaluable at the 2nd Southern Hospital that when some few months ago it became necessary to find a new administrator, there was little room for doubt as to who was the man for this responsible work. Now we warmly congratulate him on receiving his Brevet-Colonelcy, and we offer our best wishes to the O.C.

Lieut.-Col. Bush, C.M.G., now in France, has been gazetted Brevet-Colonel in recognition of his work at the Front.

Capt. J. A. Nixon, R.A.M.C.(T.), must be congratulated on being mentioned in dispatches.

Obituary.

RICHARD HUGH BREW.

DURING the twenty-three years that Richard Hugh Brew practised at Chew Magna he enriched the life of the neighbourhood, not only by his sound medical judgment and keen enthusiasm for his work and his patients' welfare, but by his exceptionally manly, amiable, yet forceful disposition ; thus his death at the age of 55 leaves a gap that none can fill for many a year.

He was born at Ballyvaughan Rectory, Co. Clare, the only son of Richard St. John Brew, an officer who died at the early age of 27, and was educated at the medical schools of Dublin and at Edinburgh, where in 1884 he obtained his diplomas of L.R.C.P., L.R.C.S., and L.M. Edin. After a short assistantship at Chesham, he practised in Birmingham, but moved to Chew Magna shortly after his marriage in 1890.

His many friends and admirers in Bristol will realise how true is the pen-portrait of Brew by his friend, written for the *British Medical Journal*, as follows :—

"Of manly physique, the picture of health and vigour, his bodily presence was the outward sign of the fine, strong spirit within." The writer (H. W. P.) had known him for the last eleven years, and as "brother, sometimes patient, and friend had come to hold him, from his sterling worth of heart and head and his sound professional knowledge, in the highest esteem. Gifted in no ordinary degree with the power of intuition, which is really the result of deep-laid and thoughtful experience, he went quickly and surely to the root of every malady, and seemed to have a right judgment in all things. Prompt in decision, fearless in opinion, without hesitation or ambiguity of speech, he straightway inspired confidence ; and take him for all in all, he was to my mind one of the best doctors I have ever known. Then, alas ! in the full tide of his work and prosperity, he was smitten down in the spring of 1915 by an obscure illness, due, it was thought, to some bacillary infection. He was at death's door, but rallied, recovered—it was thought permanently—and had been at work again for nearly a year, when there was a relapse in severer form. Nor can it be doubted that stress of work, the grave anxieties of this disastrous time, and, above all, the loss of Cyril, his much-loved younger son—a charming, gallant boy, who held a commission in the Irish Guards, and who died somewhere near Ypres after terrible wounds last October—undermined his natural strength and lowered his resisting powers."

"Only a country practitioner, but withal a man of noble, stainless character, of true humility and 'gentleness untired,' a keen sportsman, ever ready to befriend the poor, and implicitly trusted in every walk in life."

Yours sincerely
E. Hyde Shrubsall Lt. Col.

LIEUT.-COL. E. H. OPENSHAW.

In the year 1885 there came to the Bristol Medical School a boyish student, whose bright, happy face and keen, frank eyes reflected a particularly attractive and warm-hearted personality, which none of his teachers or fellow-students can have failed to cherish in memory. So full of life, energetic in work and play alike, thus was Ernest Hyde Openshaw born in the profession he adorned in after years, till the opportunity came with the declaration of war to play a glorious part as a combatant officer for which years of work and preparatory training had fitted him so well. Beloved in his practice and filling an important position in and around Cheddar, many in similar circumstances would have "carried on" at home; but not Openshaw, who was on Salisbury Plain in camp at the outbreak of war, and volunteered at once for service abroad, and sailed as second in command of the 1/4th Somersets for India on October 7th, 1914. His son, E. R. Openshaw, now attached to the Royal Flying Corps, accompanied him as 2nd-Lieutenant in his battalion, and served under him in India and in Mesopotamia. He spent some time at Wellington, in South India, and at Julindur with the battalion, and saw fighting on the N.W. Frontier in the spring of 1916. Ordered to Mesopotamia, the battalion was engaged in the Kut Relief Expeditionary Force, and in the Battle of Dujailah on March 8th he led his men in the assault on the Turkish position. After the hardships of that campaign he was invalided to India, and was later made Commandant of the Convalescent Depot at Wellington, in South India.

He was, however, anxious to return to active service with his battalion, and pressed the authorities to send him back to Mesopotamia. He remained in good health until the beginning of July, when he was reported dangerously ill, and died of heatstroke and heart-failure in hospital at Nasariyeh on the Euphrates at the age of forty-nine.

Colonel Openshaw was the eldest son of the Rev. T. W. Openshaw, for many years Mathematical Master at the Bristol Grammar School, and married the only child of Mr. Harry Fussell, of Bristol. For some time he was House Surgeon of the Bristol Eye Hospital. He went to Cheddar just after his marriage, twenty-three years ago. He was also a prominent Freemason, W.M. of Agriculture Lodge in 1903, and held the provincial rank of Junior Grand Warden of Somerset.

After completing his studies at the Bristol Medical School, Edward Hyde Openshaw qualified as L.R.C.P. and M.R.C.S. in 1890, and after spending his first three years as an assistant at Moretonhampstead and Olveston, joined Dr. R. W. Statham as partner at Cheddar, where he worked until he obeyed his country's call in 1914.

To none are the lines more truly applicable—

"No easy hopes or lies
Shall bring us to our goal;
But iron sacrifice
Of body, will, and soul.
There is one task for all,
For each one life to give.
Who stands if Freedom fall?
Who dies if England live?"

We are glad to give a few words of appreciation from Dr. Statham of the man as he was known by his large circle of friends during a period covering a quarter of a century: "To know Openshaw, or 'Bud,' the name by which he was better known to his intimate friends, was to love him. He was a man of immense power of strength, but with a heart brimful of affection, and as gentle as a child, a type of old English gentleman which we trust may never die out. A thorough sportsman in all its branches, a fearless rider, and in his early days in the football field his name was one to conjure with, he always had a happy smile and was of the most cheerful disposition, usually singing or whistling as he drove along the country lanes, while his hearty laugh and breezy manner won for him the regard and affection of all who came in contact with him. As a doctor he always inspired confidence and hope, and gave ungrudging attention both to rich and poor, possessed of a skill which is seldom met with amongst ordinary practitioners. Many a poor home will miss his generosity, and all his friends will recall those pleasant evenings spent in the garden he loved so well, and which was so wonderful for the unique collection of trees and flowers he had reared and trained with so much pride. He died as he had lived, a man and a true patriot, doing his duty for his country and his fellow-beings."

Like thousands of our fellows, Openshaw has deliberately risked and given all for the sake of those of us who live on, without thought or hope of reward, and in the full belief that we are worthy of the sacrifice. May we who stay safely at home in our tents to "mind the stuff" prove worthy of those who go forth to return beggared in health and strength or never to return. The life and the death of Openshaw is an epic that his widow, children, and friends will always remember with a legitimate pride and reverent love, that will assuage the pain of to-day, and in due time from a grave watered with such tears will spring forth fair flowers to gladden and to inspire afresh their aching hearts.